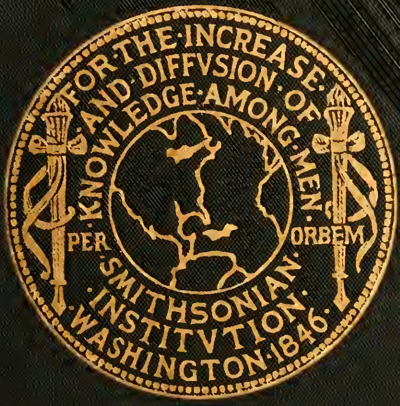

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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
BULLETIN 170

LIFE HISTORIES OF NORTH AMERICAN BIRDS OF PREY

(PART 2)

ORDERS FALCONIFORMES AND STRIGIFORMES

BY
ARTHUR CLEVELAND BENT
Taunton, Massachusetts

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ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present work forms No. 170 of the *Bulletin* series.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., *June 1, 1938.*

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INTRODUCTION

This is the eleventh in a series of bulletins of the United States National Museum on the life histories of North American birds. Previous numbers have been issued as follows:

107. Life Histories of North American Diving Birds, August 1, 1919.
113. Life Histories of North American Gulls and Terns, August 27, 1921.
121. Life Histories of North American Petrels and Pelicans and their Allies, October 19, 1922.
126. Life Histories of North American Wild Fowl (part), May 25, 1923.
130. Life Histories of North American Wild Fowl (part), June 27, 1925.
135. Life Histories of North American Marsh Birds, March 11, 1927.
142. Life Histories of North American Shore Birds (pt. 1), December 31, 1927.
146. Life Histories of North American Shore Birds (pt. 2), March 24, 1929.
162. Life Histories of North American Gallinaceous Birds, May 25, 1932.
167. Life Histories of North American Birds of Prey (pt. 1), May 3, 1937.

The same general plan has been followed, as explained in previous bulletins, and the same sources of information have been utilized. The nomenclature of the 1931 Check-List of the American Ornithologists' Union has been followed, but it has seemed best to continue in the same order of arrangement of families and species as given in the 1910 check-list.

An attempt has been made to give as full a life history as possible of the best-known subspecies of each species and to avoid duplication by writing briefly of the others and giving only the characters of the subspecies, its range, and any habits peculiar to it. In many cases certain habits, probably common to the species as a whole, have been recorded for only one subspecies; such habits are mentioned under the subspecies on which the observations were made. The distribution gives the range of the species as a whole, with only rough outlines of the ranges of the subspecies, which in many cases cannot be accurately defined.

The egg dates are the condensed results of a mass of records taken from the data in a large number of the best egg collections in the country, as well as from contributed field notes and from a few published sources. They indicate the dates on which eggs have been actually found in various parts of the country, showing the earliest and latest dates and the limits between which half the dates fall, the height of the season.

The plumages are described in only enough detail to enable the reader to trace the sequence of molts and plumages from birth to maturity and to recognize the birds in the different stages and at the different seasons. No attempt has been made to describe fully the adult plumages; this has been well done already in the many manuals. The names of colors, when in quotation marks, are taken from Ridgway's Color Standards and Nomenclature (1912), and the terms used to describe the shapes of eggs are taken from his Nomenclature of Colors (1886). In the measurements of eggs the four extremes are printed in boldface type.

Many of those who contributed material for previous bulletins have continued to cooperate. Receipt of material from nearly 400 contributors has been acknowledged previously. In addition to these, our thanks are due to the following new contributors: R. P. Allen, E. R. and M. L. Arnold, D. B. Bull, A. W. Butler, C. H. D. Clarke, Crompton Crook, J. A. Hagar, S. D. Knox, K. H. Maslowski, Theed Pearse, R. W. Quillin, H. H. Schroder, E. T. Stuart, Jr., M. G. Vaiden, F. C. Walcott, and Mrs. F. C. Willard. An attempt has been made to record the names of all contributors, but omissions may have occurred; if any contributor fails to find his name, either in this or in some previous bulletin, the author will be glad to be advised.

Dr. Charles W. Townsend and Dr. Winsor M. Tyler rendered valuable assistance in reading and indexing, for this group, a large part of the literature on North American birds, which saved the author many hours of tedious work. Dr. Townsend also contributed the entire life histories of two species, and Dr. Tyler contributed one. The Rev. Francis C. R. Jourdain contributed the life histories of three European species, and Milton P. Skinner wrote those of nine North American forms. Thanks are due also to the late Owen Durfee for many hours of careful work in copying and arranging a great mass of data on egg dates, and to F. Seymour Hersey for figuring egg measurements. Egg measurements were furnished, especially for this volume, by Griffing Bancroft, R. M. Barnes, C. E. Doe, J. R. Gillin, A. D. Henderson, T. E. McMullen, S. B. Peyton, J. H. Riley, J. S. Rowley, W. B. Savary, G. H. Stuart, 3d, J. E. Thayer, Stanton Warburton, Jr., and Miss M. W. Wythe.

Through the courtesy of the Bureau of Biological Survey, the services of Frederick C. Lincoln were again obtained to compile the distribution paragraphs. With the matchless reference files of the Biological Survey at his disposal, his many hours of careful and thorough work have produced results far more satisfactory than could have been attained by the author, who claims no credit and assumes no responsibility for this part of the work.

The manuscript for this volume was completed in April 1937. Contributions received since then will be acknowledged later. Only information of great importance could be added. The reader is reminded again that this is a cooperative work; if he fails to find in these volumes anything that he knows about the birds, he can blame himself for not having sent the information to

THE AUTHOR.

LIFE HISTORIES OF NORTH AMERICAN BIRDS OF PREY

(PART 2)

ORDERS FALCONIFORMES AND STRIGIFORMES

By ARTHUR CLEVELAND BENT

Taunton, Massachusetts

Order FALCONIFORMES

Family FALCONIDAE: Caracaras and Falcons

FALCO RUSTICOLUS CANDICANS Gmelin

WHITE GYRFALCON

PLATES 1–4

HABITS

THE gyrfalcons have always been a very puzzling group; their nomenclature has been confusing, their relationships have never been well understood, and confusion as to the distribution of the different forms has been even worse. Various views on all these points have been expressed by different writers, but none of them are conclusive or wholly satisfactory. Until we have available a considerable series of breeding birds, both adults and their young, collected in various parts of the breeding ranges, we shall never fully understand the relationships of the various forms and their ranges. Most of the specimens in collections are late fall or winter birds, which may have wandered far from their native ranges. Even summer specimens are not necessarily breeding birds, as immature birds and nonbreeding adults are often widely scattered in summer. We need also a series of young birds in juvenal plumage, taken before, or soon after, the flight stage is reached, to help us recognize with certainty the immature plumages of the different races.

At one time the white gyrfalcons of northern Greenland were considered as specifically distinct from the gray forms, but it now seems to be generally conceded that all the forms are races of one species, *Falco rusticolus.* The British Ornithologists' Union List (1915) recognizes two species, *Hierofalco gyrfalco* and *H. islandus*, each with two subspecies, only three of the four forms being listed as British. But Witherby's Handbook (1924) includes the three British forms as subspecies under *rusticolus*. Peters's Check-List (1931) names five races from different parts of the world, all as subspecies of *rusticolus*. Only three of these are included as North American in the latest American Ornithologists' Union Check-List (1931). I examined the large series of specimens in the Museum of Comparative Zoology, on which Mr. Peters based his conclusions, and I believe his treatment of the group is as nearly correct as our present knowledge permits.

The distribution given in the A. O. U. Check-List (1931), which is practically the same as that given by Peters (1931), is, I believe, substantially correct, but I doubt if *candicans* breeds regularly anywhere on the North American Continent; the Asiatic form, *uralensis*, very likely does extend its breeding range into extreme northern Alaska but probably not onto the southern Bering Sea coast. Apparently all the gyrfalcons that breed regularly on the North American mainland are referable to *obsoletus*. The breeding records of the white gyrfalcons in Labrador and Ungava, mentioned below, doubtless represent cases of casual breeding far south of the normal breeding range.

The white gyrfalcon (*Falco rusticolus candicans*) breeds in northern Greenland at least as far south as latitude 76° N. and perhaps farther on the west coast; on the east coast it may breed farther south than on the west coast, as the east coast is much colder. In southern Greenland, at least from Disco Island southward, the breeding birds are darker, but just what their status is has not yet been definitely determined. Dr. Walter Koelz (1929), who went to Greenland on one of the MacMillan expeditions, brought back a fine series of these falcons; these are deposited in the University of Michigan collection, which now contains 88 Greenland gyrfalcons. In this large series he found specimens from various points in southern Greenland, from latitude 73° southward on the west coast, which compare favorably with the Iceland bird (*islandus*), with the Scandinavian bird (*rusticolus*), and with the dark North American bird (*obsoletus*). These puzzling variations are probably due to interbreeding with birds from Labrador, or possibly from Iceland. Such strong-flying and wide-ranging birds could easily fly from either of these places to Greenland and might become established there. Ptarmigans regularly migrate between Greenland and Labrador, and the short distance could easily be covered by a gyrfalcon. It is conceivable that *obsoletus*, the dark Labrador race, might regularly migrate to southern Greenland and, by interbreeding with the light northern race, produce a variety of intermediates.

Dr. Frank M. Chapman's (1899) study of a collection of 33 gyrfalcons from Greenland shows much the same range of variation from the lightest to the darkest forms. He says: "Four examples are dark enough to be referred to *F. r. obsoletus*, one of them being fully as dark as the darkest of three specimens from Ungava, Labrador kindly loaned me by Mr. Ridgway, and warrant the addition of *Falco rusticolus obsoletus* to the Greenland fauna. These birds are connected with the lighter specimens in the series by finely graded stages."

Nesting.—First-hand, reliable information on the nesting habits of the white gyrfalcon is very scanty. A. L. V. Manniche (1910) found five nests in northeastern Greenland, where *candicans* proved to be the breeding form. He writes:

> I only succeeded in making relatively few observations regarding the breeding of the Gyrfalcon. Only one of the nests found was accessible viz. that on Nordre Orienterings.
>
> May 19th 1907 I shot an old female at this nest; judging from her exterior she must have been sick, certainly from an inflammation of her oviduct. In her ovary were found 5 rather developed eggs. She had very pale plumage and orange-yellow feet. In the nest was lying a fresh egg, which on one side had a crack caused by frost. Like the other eyries observed, this one was conspicuously marked by heaps of excrements and remnants from the meals of the birds such as pellets, bones and other remains of animals. It was placed only 10 meters above the level of the sea on the northern side of the rock, which rises precipitously and steeply from the Stormbugt.
>
> Judging from the enormous heaps of excrements the nest had certainly been inhabited for many years. The bottom of the nest was formed only by the excrements of the birds.
>
> A falcon flying out from this nest was observed July 14th in the same year, so the male must within a short time have found another mate.
>
> The next spring the female falcon was observed at the nest already April 20th. The breeding did, however, not commence before May 26th.
>
> I often passed the nest and thus had good opportunity to observe the breeding falcon.
>
> She kept very close to the nest, and did not leave it, even if I approached to the very side of the rock, only stretching out her neck to eye me anxiously. The male used to sit on the projections not far from the nest.
>
> June 22nd I arrived together with two of my companions in a dogsledge at the eyrie of the falcon, intending to secure the young ones now supposed to be hatched.
>
> The 4 eggs were, however, not yet hatched, but I could plainly hear the hoarse cries of the young ones within. The shells were still unbroken with exception of one, that had an insignificant crack. I kept the eggs warm by putting them under my shirt against my body.
>
> Having sledged for some hours we arrived at my station at Stormkap, and here I continued my brooding of the eggs in my sleeping-bag.
>
> The first of the young ones emerged on June 23rd the next three 24 hours later. The time of incubation for this clutch of eggs was thus nearly 29 days.
>
> The female Falcon behaved very anxiously when I ascended the rock and she very unwillingly left her nest. Several times she rushed swiftly and vigorously towards the disturber. The male, which proved very cautious, left the rock, when the female was shot.

> * * * June 8th 1908 I found another nest of Gyrfalcon on the steep northern side of the mountain Trekroner. This nest was placed at least 200 meters over the level of the ground and was quite inaccessible.
>
> The enormously high heaps of excrements around the nest formed a large whitish-yellow ledge and could be seen from a distance of 3 km. Around the eyrie a colony of Barnacles (*Anser leucopsis*) had their nesting places. I was surprised to see, that the Geese were sitting in couples on the projections close to the Falcons.
>
> When I—by means of a pair of rifle bullets—caused the breeding falcon to fly out of her nest, she and the male circled around the mountain in company with the Geese for a long while. From a dizzy height the falcon at last swift as an arrow shot down to the nest and was soon followed by the Barnacles, which again confidently took their seat close by.
>
> This eyrie also looked as if it had been used from immemorial time.
>
> Falcons eyries were also recorded on the high rock Teufelkap and on a rock near the Mørkefjord; both of them were—like the two already mentioned nests—built on the northern side of the mountains. This was also the case with the 5th nest of a bird of prey, which was found, and which certainly also belonged to a Gyrfalcon.
>
> This can hardly be considered accidental; perhaps the falcons choose to nest on places, which in the coldest time of the day and night are warmed by the midnight sun; it must be remembered, that the breeding-time is partly in May, in which month the temperature of the nights is usually some degrees under zero.

Lucien M. Turner, in his unpublished notes, records the nesting of a pair of white gyrfalcons in northern Ungava, as follows:

> A pair was building their nest on the side of the bluff known as Hawk's Head, some two miles north of Fort Chimo. I undertook to ascend the bluff by means of a rope drawing me up a distance of 168 feet, where I had nothing to cling to but the rope and be whirled round and round dozens of times (as the nest was on a part which could not be reached from above) until, when I reached the spot where the nest was located, I was so dizzy that I was glad to find a resting place; and, when I attained the site, I put my foot directly on the half completed nest, composed of a few sticks and a great quantity of dry grass, forming a bulk about 15 inches across the top and 3 inches high. The birds were whirling and screaming off at a distance while a man was firing at them. The birds deserted the locality and were not seen again.

Audubon's (1840) account of the finding of a nest of white gyrfalcons near Bras d'Or on the southern coast of Labrador on August 6, 1833, seems worthy of credence. Both parent birds were shot at the nest, and his drawing, made on the spot, is unmistakable. As this is far south of the present known breeding range, it must have been a very exceptional case. He describes the nest as follows:

> The nest of these hawks was placed on the rocks, about fifty feet from their summit, and more than a hundred from their base. Two other birds of the same species, and apparently in the same plumage, now left their eyry in the cliff, and flew off. The party having ascended by a circuitous and dangerous route, contrived to obtain a view of the nest, which, however, was empty. It was composed of sticks, sea-weeds, and mosses, about two feet in diameter, and almost flat. About its edges were strewed the remains of their food, and beneath, on the margin of the stream, lay a quantity of wings of the *Uria Troile*, *Mormon arcticus*, and *Tetrao Saliceti*, together with large pellets composed of fur, bones, and various substances.

Eggs.—The white gyrfalcon lays ordinarily four or five eggs; these are indistinguishable from those of the other races of the species, which are described under *obsoletus.* The measurements of 90 eggs average 58.7 by 45.7 millimeters; the eggs showing the four extremes measure **64.4** by **50.8**, **53.5** by 44.5, and 56.9 by **41.4** millimeters.

Plumages.—I have never seen the downy young of this falcon and doubt if there are any anywhere in American collections. This race is easily recognized at any age, as it is always much whiter than any of the other gyrfalcons. Dr. Koelz (1929) describes two nestlings, which were still in the nest but fully feathered, as follows:

> The under parts are entirely white with a creamy cast, except for a band of narrow streaking of brown on the feathers of the breast (the male specimen has only the sides of the breast streaked), and broader streaks of the same color on the feathers of the sides. The under tail coverts and the tarsals are immaculate. The general tone is white above. The top and the sides of the head are faintly lined along the feather shafts with dark brown. The feathers of the back have a streak of brown along the shaft of the feathers, which broadens as it nears the tip to become rather pendant shaped. On the shortest scapulars the drop becomes broader so that the feathers here may be described as brown with a broad border of white. The upper tail coverts are streaked like the breast. The tail feathers are pure white. The wing coverts are marked about like the scapulars; the short ones with a central field of brown and the longest ones with broken v-shaped crossbars. The wing feathers are white with dark shafts and a few broken bands of dark brown, chiefly near the tips.

The two nestlings, described above, came from Etah in northern Greenland. Of an adult *candicans*, also from northern Greenland, he says:

> The adult has the entire under parts immaculate. The back is chiefly white. The crown, sides of head, and fore part of the back are unspotted except for a few lines of black brown on the ear coverts and on a few feathers of the occiput. The upper tail coverts, the rest of the back, and the wing coverts are barred with arrow-shaped blotches of black brown. The tail is virtually pure white. The plumages of adult and juvenile are thus different. Young birds have the markings paler, probably more numerous, and they tend to run lengthwise of the feather, especially on the short feathers.

Specimens from farther south in Greenland, both juvenals and adults, are darker, showing resemblances to corresponding plumages of *islandus*, *rusticolus*, or even *obsoletus.* These are, of course, not true *candicans* and have probably been produced by interbreeding with the dark birds from Labrador. Hagerup (1891) says that "Holboll and Fencker repeatedly observed mated pairs, one of which was white (*F. islandicus*), and the other dark (*F. rusticolus*)" and that "Holboll also found light and dark colored young in the same nest." The latter is just what might be expected, as a result of the former, under the well-known laws of heredity.

The juvenal plumage is worn for a year or more and then gradually molted between June and January. This new plumage is practically adult. Mr. Turner says that subsequent plumage changes are much like "those of the snowy owl and extremely old birds become pure white with the exception of the tips of the wings."

Food.—The two species of ptarmigans seem to furnish the principal food supply of this gyrfalcon, especially in winter, when they are about the only birds available in the far north. Mr. Turner says that at Fort Chimo it is called the "partridge hawk" by the English-speaking people, who apply the name of "partridge" to both ptarmigans and to the spruce grouse. Manniche (1910) says that it feeds mainly on lemmings in northeastern Greenland, as well as on various birds and occasionally on the Alpine hare. When springtime brings the hosts of summer birds to the Arctic shores, the falcons feast and feed their young on the numerous sea birds, dovekies, puffins, murres, guillemots, and kittiwakes. They are even strong enough to kill the eiders and other ducks and geese. The smaller land birds and shorebirds are less often taken, but golden and ringed plovers, phalaropes, snipes, turnstones, dunlins, purple sandpipers, and snow buntings have been recorded in their food.

Manniche (1910) writes:

> The falcons appeared most numerously near the ship to which they were allured by the pigeons of the expedition. From September 3rd to 17th 17 falcons were shot here. Often 4 to 5 individuals would appear at one time either circling around the mast-heads, on which they sometimes settled, or sitting around on the surrounding hummocks of ice or blocks of stone, watching for pigeons.
>
> As soon as these were started in the air, they were most violently pursued by one or several falcons which, however, never succeeded in capturing a pigeon.
>
> I often saw a falcon and a pigeon manoeuvering for a long while extremely high up in the air until the pigeon finally—swift as an arrow—vertically shot down to the ship and entered the pigeon-house, which was built on the deck, all the while pursued by the falcon, which stretching its talons forward and uttering angry cries would only give up the chase just before the entrance-hole of the pigeon-house. During this autumn 40 falcons were shot—all of them young birds, and at least 5 times as many were seen.

During its winter wanderings this falcon preys on the native grouse, and sometimes attacks domestic poultry. Elsie Cassells (1922) reports that "a fine specimen of the White Gyrfalcon was shot by Mr. Waghorn on his farm at Blackfalds, Alberta, in the act of attacking one of his turkeys in December, 1920." M. J. Magee (1932) refers to two cases of its eating prairie chickens; in one case "the bird had inside it 140 grams of Prairie Chicken, meat, bones and feathers."

Behavior.—There seems to be no great admiration among observers for the swiftness and skill of the gyrfalcon in capturing its prey in flight. The foregoing statement by Manniche (1910) would seem to indicate that the pigeons were more than a match for it. Hagerup (1891) had a similar experience; he flew his pigeons regularly to attract gyrfalcons but never lost a pigeon. Manniche (1910) also says that a gyrfalcon cannot catch a phalarope on the wing. Kumlien (1879) says: "I often had an opportunity of witnessing this hawk preying upon jaegers, kittiwakes, &c., but was surprised that they are not possessed of swifter flight. A duck hawk would have made a short job of catching a kittiwake that one of these hawks followed till he fairly tired the bird out. Their success seems to depend more upon a stubborn perseverance than alacrity of flight."

Audubon (1840) writes:

> Their flight resembled that of the Peregrine Falcon, but was more elevated, majestic, and rapid. They rarely sailed when travelling to and fro, but used a constant beat of their wings. When over the Puffins, and high in the air, they would hover almost motionless, as if watching the proper moment to close their pinions, and when that arrived, they would descend almost perpendicularly on their unsuspecting victims.
>
> Their cries also resembled those of the Peregrine Falcon, being loud, shrill, and piercing. Now and then they would alight on some of the high stakes placed on the shore as beacons to the fishermen who visit the coast, and stand for a few minutes, not erect like most other Hawks, but in the position of a Lestris or Tern, after which they would resume their avocations, and pounce upon a Puffin, which they generally did while the poor bird was standing on the ground at the very entrance of its burrow, apparently quite unaware of the approach of its powerful enemy. The Puffin appeared to form no impediment to the flight of the Hawk, which merely shook itself after rising in the air, as if to arrange its plumage, as the Fish Hawk does when it has emerged from the water with a fish in its talons.

Turner says, in his notes: "The manner of flight is by rapid beats of the wings followed by a short sail. They dart with astounding swiftness among a flock of ptarmigans and seize them while the prey is flying or on the run. The hawk carries the bird to a convenient spot to be devoured; or oftentimes consumes it where it was taken. This depends on the particular location, which, if commanding a good view, the falcon will not carry the food, but, if it is in a low spot, the ptarmigan is usually carried to higher ground. I have never seen this hawk alight in trees, always on the earth."

Dr. W. Elmer Ekblaw thus describes, in his notes, an attack on a glaucous gull by a pair of white gyrfalcons, probably in an attempt to drive the gull away from the vicinity of their nest:

> The big gull seemed much harassed. While I watched he appeared to become fatigued and more vulnerable to the attack. At first he evaded every stoop the falcons made, either by rising to meet them or by suddenly dodging. He would fly fast and strong in a straight line and then suddenly, as the hawks caught up with him and gained the advantage by being above him, he would double abruptly on his course while the falcons, apparently not able to alter the direction of their flight so quickly as he, would lose both distance and advantage by sailing on by him. Whenever the hawks pounced down upon him, he would rise quickly and obliquely to meet them, but at the last of the fight, as I saw it, he failed to meet them promptly as at first and they often succeeded in striking him about the head. Always as they did so, he screamed angrily and worriedly. The method of the attack of the falcons was to rise above him and dash or stoop down upon him from behind, first one striking him and then the other, and then rising above him again. Immediately after each strike they would give a piercing whistle.

Enemies.—Manniche (1910) relates the following two incidents in which the gyrfalcons were attacked by other birds:

> A falcon was in the most violent manner attacked by two Ravens. The quarrelling birds flew for a while around high up in the air uttering angry cries, after which the Ravens descended and took place side by side on a rock evidently lurking after Lemmings, the holes of which were numerous around the place. The falcon also settled with the same intention on another rock some 50 meters from the Ravens. At my approach the birds rose again in the air and immediately continued their battle. The Ravens seemed much superior to the falcon, which therefore showed an inclination to fly away to avoid their rough treatment.
>
> The battle at last took place just over my head, and I shot one Raven in order to make the fight more even.
>
> Frightened by the shot the two other birds flew away in different directions, but they soon met again, and took up the battle nearer to the coast. Here the falcon got relief from two birds of its own kin, and now the Raven was obliged to depart hastily, while the three falcons settled on the summit of a rock.
>
> Not rarely I observed falcons pursued by Skuas (*Lestris longicauda*). At the end of August the young Skuas will frequently be sitting around on stones, still cared for by their parents, which with extreme violence will guard their offspring against attacks from falcons. The Skuas exceed by far the Gyrfalcons in ability of flight, and the falcons therefore always wish to escape the pursuit and retire to the rocks. Most frequently 3 or 4 Skuas would join in an attack; the battle would usually be fought out immensely high up in the air.

Field marks.—This bird can be recognized as a falcon by its long pointed wings and its manner of flight, rapid wing beats with occasional short sailings, or a stationary, hovering flight. But only by its greater size can it be known as a gyrfalcon. If it has a wholly white breast and is mainly white above, it is an adult white gyrfalcon; even young birds of this race are nearly white below and largely white above. All other gyrfalcons are considerably mottled or streaked on the under parts and dark colored above. Gyrfalcons are not likely to be seen within the United States except in winter.

Winter.—Some of the gyrfalcons remain far north throughout the winter, wherever they can find a sufficient food supply. But, as the ptarmigans migrate southward, many of the falcons have to follow them. White gyrfalcons are much commoner in winter than in summer in southern Greenland. Bernhard Hantzsch (1929), writing of northeastern Labrador, says:

> It most probably does not breed until northward of our district, but reaches it occasionally as a visitor and migrant. The birds, especially in autumn, regularly follow the flights of the ptarmigan which make their favorite food. However, they feed upon everything else possible, apparently not only on living creatures. The inhabitants not seldom find them during the winter in the baited fox-traps, by which the birds become annoying to them. These more or less light winter visitors and migrants are far more frequent than the dark breeding birds; indeed, in many years of abundant snow they are said to occur in rather large numbers.

Mr. Turner says that this "bird is far more numerous from September to April than at other times" in Ungava. At this season it wanders far from its summer haunts in search of food, though only rarely to the southern Provinces of Canada and to the northern States.

DISTRIBUTION

Range.—The species is circumpolar in its distribution and confined almost entirely to the Arctic and sub-Arctic regions, wandering irregularly south to the Northern United States, the British Isles, central Europe, and Kamchatka.

Breeding range.—In North America the gyrfalcon breeds **north** to northern Alaska (Tuksuk River, Kotzebue Sound, Fort Yukon, Point Barrow, and the Porcupine River "above Fort Yukon"); Grinnell Land (Cape Hayes); and Greenland (Godhavn). **East** to Greenland (Godhavn, Holsteinborg, Frederikshaab, and Ivigtut). **South** to southern Greenland (Ivigtut); Labrador (Cape Chidley and Port Purnell); Ungava (Chimo); southern Franklin (Iglulik and Felix Harbor); northern Mackenzie (Fort Anderson); and Alaska (Crater Mountain). **West** to Alaska (Crater Mountain and Tuksuk River). The species also is reported to breed on the east coast of Greenland; for exact details see Manniche (1910).

Winter range.—The precise limits of the winter range are difficult to define, as the gyrfalcon is resident in many high latitudes as in Alaska (Nulato), Ungava (Chimo), and Greenland. Its southward movements are always irregular, but based upon frequency of occurrence the winter range may be stated as **south** to Massachusetts (Ipswich, Northampton, and Melrose); Rhode Island (Providence, Tiverton, and Newport); Connecticut (Durham); New York (Fishers Island, Quogue, Oceanside, Flushing, Chester, Canandaigua, and Monroe County); Pennsylvania (Kittatinny Ridge and Manheim); southern Ontario (Ottawa); Wisconsin (Beaver Dam); Minnesota (Minneapolis and Madison); Montana (Shonkin and Fortine); and southern British Columbia (Saanich, mouth of the Fraser River, and Comox).

As above sketched the territory includes all races of the gyrfalcon that are found in North America, but, as has been previously indicated, the respective ranges are not clearly understood. Generally speaking, the typical North American race is the black gyrfalcon (*Falco r. obsoletus*), which is found from northern Alaska to Labrador, wandering southward to New England, Pennsylvania, the Dakotas, British Columbia, and, casually, even farther. The white gyrfalcon (*F. r. candicans*) is resident in Greenland and possibly also in extreme northeastern Canada. It too is known occasionally to wander south to the Northern United States. The Asiatic gyrfalcon (*F. r. uralensis*) is found in northern Siberia east to Kamchatka and the islands in

Bering Sea. It has been recorded as breeding on the coast of Alaska (Deering, Kotzebue Sound, and Muller Bay).

Migration.—Very little information is available concerning the movements of the gyrfalcons. In the fall of 1905 there appears to have been a rather extensive southern movement in both Europe and North America. It has been recorded that during the fall of 1908 they were abundant at Winter Harbor, Franklin, and that the last one seen was on September 8. The Kittatinny Ridge in Pennsylvania is apparently a good observation post for this species, several having been noted there in the fall of 1934, from October 11 to November 2.

Nothing is known of the return trip to the north.

Casual records.—There are several widely scattered records of occurrence south of the winter range above outlined. Among these are: Ohio, a specimen from Washington Court House on January 30, 1907; North Dakota, one collected at Grafton, on October 7, 1908; South Dakota, one on October 21, 1880, near Vermillion; Kansas, one at Manhattan on December 1, 1880; Wyoming, one noted at Fort McKinney during the winter of 1883–84; and Washington, a specimen collected near Spokane, in December 1896.

Egg dates.—Greenland: 5 records, May 6 to June 13.

Arctic America: 6 records, May 9 to June 12.

Labrador: 3 records, May 22 to 28.

FALCO RUSTICOLUS OBSOLETUS Gmelin

BLACK GYRFALCON

Plates 1–4

HABITS

This, the darkest of all the gyrfalcons, was formerly supposed to be confined to Labrador in the breeding season; but now it is generally conceded to be the dominant American form, breeding all across the northern part of the continent from Labrador to northern Alaska. Lucien M. Turner says in his unpublished notes on the birds of Ungava:

> This species may be considered common, as it is the most abundant hawk in the region. During the excessively cold periods of winter but few are to be seen. About the middle of March they are more numerous, and they become plentiful by the last of April. They evidently retire to the southern portion of the region for the winter. As soon as the warm days of April arrive these birds seek their mates and, from the evidence presented under the remarks on the eggs procured, it would seem that their courtship is of short duration. These hawks have no special preference for any particular portion of the country, whether it be barren or wooded.

Dr. E. W. Nelson (1887) says of its status in northern Alaska, though some of his notes may refer to *uralensis:*

Throughout all Alaska, from the Aleutian Islands, north, both along the coast and through the interior, extending from Bering Straits across the northern portion of British America, the present falcon is the commonest resident bird of prey. It was observed by Murdoch at Point Barrow, though it was not common. It frequents the vicinity of cliffs and rocky points about the sea coast, or the rocky ravines of the interior, during the breeding season, and the remainder of the year, especially in fall, it is found wandering over the country everywhere that food can be obtained; it is especially numerous during the migration of the Ptarmigan along the sea-coast.

Nesting.—Mr. Turner's notes contain the following account of a nest he examined near Fort Chimo, Ungava, on May 22, 1883:

The "Chapel" is an immense rock some 300 feet above the surrounding rocks, and gradually slopes upward to the north end, which is almost precipitous and absolutely inaccessible. The eastern side is more abrupt, being in places over 200 feet almost perpendicular. Here are several ledges on which these hawks have built their nests for many years. On April 7, 1883, I observed beneath the nest site first selected a number of sticks and other refuse lying on the snow below, as if the situation had been subjected to a rearrangement or cleansing process; such material as appeared unnecessary was rejected and cast over the side of the ledge. The site of this nest was a narrow ledge of rock, which projected from the main wall and embraced an area of not over three superficial feet. Here was an accumulation of spruce and larch twigs and branches of various sizes imbedded in what appeared to be the accumulated debris of many generations. Among this a few grass seeds had found enough soil to enable them to send forth a rank growth which was now appearing. The mass or accumulation was about 10 inches deep and covered nearly the entire surface of the ledge, heaped up immediately under the new nest, forming an irregularly truncated cone of matter on which the nest was placed. In front of it huge icicles stood and joined with the slightly projecting roof above the ledge. Some of these ice columns were 2 or 3 inches thick and 4 inches wide. They formed an icy palisade around the edge of the nest and permitted approach to the interior only by a narrow space, or doorway, next to the main wall of rock. I was compelled to detach the ice before I could reach the four eggs which I saw within the nest. The nest was composed of a few twigs and branches of larch and spruce, irregularly disposed on only the outer side of the rim of the nest to prevent the eggs from rolling out, forming only a semicircular protection, while the rear portion was a part of the bare rock of the ledge. Below the twigs were the remains of former nests. Some of the sticks were so rotten that they would not support their weight when held by one end. The eggs were placed nearly touching each other.

Major Bendire (1892) writes:

Mr. R. MacFarlane, chief factor of the Hudson Bay Company, states that this Falcon is common in the wooded country on both sides of the Anderson River, and from the fact that over twenty nests were secured by him this must certainly be the case. All of these nests, with but two exceptions, were placed close to or near the tops of the tallest trees in the neighborhood, generally in pines. One nest was built on a ledge of rocks and the other against the side of a deep ravine. The nests were composed of sticks and small branches and lined with mosses, hay, deer hair, feathers, etc. They were similar in composition but smaller in size than those of the Bald Eagle, and while the number of eggs was either three or four, their contents were frequently found in different stages of development.

Both parents manifested much anger and excitement when interfered with, or even distantly approached. They made a great noise, and indeed more than once their folly in coming so near and screaming so loudly over our heads attracted attention to some that would otherwise have escaped notice. The earliest date of finding a nest was May 10, 1863, at Anderson River Fort. The eggs, three in number, were quite fresh. In another, taken five days later, the eggs contained partially formed embryos. In a few cases young birds were found in the same nest with eggs, the contents of which were but little changed, and in another nest a perfectly fresh egg was found with several ready to hatch. In nearly every case the eggs seemed to be in different stages of development, and incubation seems to begin as soon as the first egg is laid.

Eggs.—I cannot do better than to quote Bendire's (1892) description of the eggs, which will apply equally well to all the gyrfalcons, as follows:

> The eggs are three or four in number. The ground color, when distinctly visible, which is not often the case, is creamy white. This is usually hidden by a pale cinnamon rufous suffusion. In an occasional specimen it seems to be pinkish vinaceous. The eggs are closely spotted and blotched with small, irregular markings of dark reddish brown, brick-red, ochraceous rufous, and tawny. These markings—usually pretty evenly distributed over the entire egg—are generally small in size, and more or less confluent. Some specimens show scarcely any trace of markings, the egg being of nearly uniform color throughout. * * * In the general pattern of markings the eggs of the Gyrfalcon approach those of the Prairie Falcon (*Falco mexicanus*) much closer than those of the Duck Hawk (*Falco peregrinus anatum*), which as a rule are much darker. In shape they vary from ovate to rounded ovate. The shells of these eggs feel rough to the touch, are irregularly granulated, and without luster.

The measurements of 55 eggs average 59.4 by 45.3 millimeters; the eggs showing the four extremes measure **63** by 46.5, 61 by **48**, **56** by 46.2, and 61 by **42** millimeters.

Young.—Mr. Turner says in his notes: "The young birds are able to leave the nest by the middle of August, and in September of some years they are quite abundant, flying over the houses at Fort Chimo with but little fear. They generally evince but little disposition to show fierceness, and on only two occasions did they display more than ordinary courage. They will not seize with the beak when wounded, but will grasp firmly with the claws. They immediately lie on their backs when wounded."

Plumages.—So far as I know, there are no specimens of the small downy young of this gyrfalcon in any American collection. Witherby's Handbook (1924) describes a very young specimen of *rusticolus* as follows: "Down white with a slight creamy tinge, rather short, covering bird well on upper parts, but thinly on sides of belly and bare patch at base of sides of neck."

A small nestling of the Iceland bird, in the Museum of Comparative Zoology, is about half grown but still largely downy; the "clove brown" juvenal plumage is growing on the crown, scapulars, wings, tail, and sides of the breast; otherwise it is thickly covered with long, soft, woolly down, white to buffy white in color.

I have not seen any young of the black gyrfalcon in fresh juvenal plumage. Except for generally darker colors, it is probably much like the European bird of that age, of which Witherby's Handbook (1924) says in part: "Upper mantle usually uniform dark brown, rest of mantle and scapulars dark brown, feathers with brownish-white edgings and spots; back, rump and upper tail-coverts with rather larger spots and edgings, often forming bars on upper tail-coverts; chin white, streaked dark brown; rest of under-parts very widely streaked dark brown, feathers of flanks mostly dark brown with white edgings and spots."

Evidently the light-colored spots and edgings wear away during the first fall and winter, for many immature birds in our series have uniformly dark brown upper parts. Some, or perhaps all, of these may be more than a year old and may have partially molted their juvenal plumage. This first, postjuvenal, molt is much prolonged, beginning in summer, when the young bird is a year old, and continuing into the following winter. Consequently there are many birds in collections that are in this transition stage. All the immature specimens of *obsoletus* that I have seen are heavily streaked on the under parts with "clove brown" or brownish black, in many so heavily that the dark color predominates. Mr. Turner says that "birds of the year may be distinguished by the color of the cere, tarsus, toes, and eyelids being of a pale blue, while in the adults these portions are bright yellow at all seasons." Young birds do not reach maturity in plumage until they are nearly, or quite, 18 months old.

In the normal adult plumage the crown, mantle, and wing coverts are quite uniformly dark brown, "olive-brown" to "clove brown", sometimes interrupted by a few whitish streaks on the nape; the lower back, rump, and upper tail coverts are grayer, or slaty plumbeous, but not nearly so bluish gray as in the European birds; the upper breast is heavily streaked, the belly heavily spotted with round spots, and the flanks broadly barred with blackish brown or nearly black. In some birds the entire body plumage, above and below, is nearly uniform, dark, sooty brown, with little or no whitish anywhere; these are probably melanistic individuals, or they may represent a dark phase.

Ridgway (1880b) has described the adult plumage in detail. Adults apparently have one complete annual molt between June and January, though some of the primaries may be molted in spring.

Food.—The food of this gyrfalcon is much the same as that of the preceding race, with due allowance for the difference in habitat. Mr. Turner says: "Their food consists almost exclusively of ptarmigans, little else ever being found in their stomachs. They seize their prey while on the wing, depending doubtless on their sudden appearance among a flock of ptarmigans to put their prey to flight when it may be secured. Their food is devoured on the ground. I have never seen them carry it in their talons."

During their winter wanderings they feed on whatever living prey they can find, such as rabbits, squirrels, rats, domestic poultry, grouse, and wild ducks and geese. A bird in my collection, shot at Tiverton, R. I., on December 26, 1896, was hovering over some wooden duck decoys, as if about to pounce upon one of them. Henry A. Purdie (1879) recorded the capture of a gyrfalcon in Piscataquis County, Maine, in December 1876, of which he says: "It had caught several hens, and having pursued one under a barn through a small opening was itself caught in the arms of a man as it came out." Arthur H. Norton (1907) records the capture of a specimen near Portland, Maine, on December 11, 1906; he writes: "It swooped into the hen yard of Mrs. John Smith on Allen Avenue, killing a large, pugnacious rooster, which it speedily began to devour."

Behavior.—Mr. Turner's notes state that "their manner of flight is by extremely rapid wing beats followed by sailing for a few rods. They pass through the air with great rapidity; no bird of prey in those regions flies more rapidly. They dart upon their prey at a dash, bringing up, just at the moment of seizing, in an almost perpendicular position, doubtless to stop their momentum. I do not think they attempt to fly over the bird they wish to seize, but secure it by flying against and seizing it during the moment of shock. They fall to the ground with the bird seized."

Maj. Allan Brooks (1900) says: "The flight of this Falcon is as a rule rather slow compared with that of other large Falcons, but when in pursuit of a Duck it gets up a tremendous velocity and can turn and twist almost as quickly as a Goshawk. In ordinary flight the wing stroke is much shorter than a Peregrine's, and the bird when going straight away appears to be hovering like a Kestrel."

Sir John Richardson (Swainson and Richardson, 1831) had a pair of gyrfalcons attack him while he was climbing in the vicinity of their nest; he writes: "They flew in circles, uttering loud and harsh screams, and alternately stooping with such velocity, that their motion through the air produced a loud rushing noise; they struck their claws within an inch or two of my head. I endeavoured, by keeping the barrel of my gun close to my cheek, and suddenly elevating its muzzle when they were in the act of striking, to ascertain whether they had the power of instantaneously changing the direction of their rapid course, and found that they invariably rose above the obstacle with the quickness of thought, showing equal acuteness of vision and power of motion."

Voice.—Turner says: "The only note ever heard from this hawk was a chattering scream of the syllables, *ke a*, *ke a*, *ke a*, repeated a number of times, more rapidly toward the fifth or sixth utterance, and finally so blended that the sound is a rattling scream. The sound is produced only when danger is sighted."

Field marks.—This bird can be recognized as a falcon by its shape and manner of flight, as explained under the preceding race, but as a gyrfalcon only by its size. It is much darker than *candicans* in all plumages, sometimes appearing almost wholly dark brown, or almost black in certain lights.

Winter.—The winter range of the black gyrfalcon is much the same as that of the white gyrfalcon, though it ranges more widely and somewhat farther south into the United States. Many individuals, mainly adults, remain on or near their breeding grounds all winter. Dr. Nelson (1887) writes: "Along the Lower Yukon and Kuskoquim Rivers in winter it is numerous, and finds an abundance of Ptarmigan, upon which it preys. At this season it is frequently seen perching on a stout branch of a tree overhanging the river bank, and I have seen it on several occasions allow a train of dog-sledges to pass within 40 or 50 yards, only noticing their presence by slowly turning its head."

FALCO RUSTICOLUS URALENSIS (Sewertzov and Menzbier)

ASIATIC GYRFALCON

HABITS

This subspecies was described from specimens from the Ural Mountains in eastern Russia. Its range extends through Siberia to Kamchatka, to the Commander Islands, to St. Lawrence Island, St. George Island, and probably other islands in Bering Sea, and to northern Alaska. A female in my collection, in fresh juvenal plumage, was taken at Deering, Kotzebue Sound, Alaska, on August 1, 1914; it was probably hatched in that vicinity, as it was still accompanied by its parent. A breeding female, with bare incubation spaces, was taken at Muller Bay, Alaska, on May 24, 1903. That this race migrates, or wanders occasionally, down the Pacific coast of North America is illustrated by an adult specimen taken in December 1896 near Spokane, Wash.

D. Bernard Bull, who has had about 3 years of experience with this gyrfalcon on the Bering Sea coast of Alaska, has sent me some interesting notes on it; he says of its haunts and distribution: "The Asiatic gyrfalcon, like some other falcons, seems to prefer country that is open and free from timber for hunting, and where ledges of a rocky cliff or a high dirt bank are available for a nesting site. Such conditions prevail at Goodnews Bay and adjacent territory on the Bering Sea coast of Alaska, where this bird breeds and is partly, if not wholly, resident. I am confident also that it may be found nesting on Nunivak Island, at Nelson Island, and in the hills 15 miles east of the village of Hooper Bay. At these three places, although I did not take specimens, conversations with Eskimo natives convince me that gyrfalcons nest there regularly. In conversation with the natives, there was no doubt between us as to the specific identity of the bird, for we used the native name *ka-gukh-tuk*, which is applied to the Asiatic gyrfalcon by the natives at all places mentioned in these notes."

Nesting.—Until Mr. Bull's notes were received, we had very little information on the nesting habits of this gyrfalcon. The bird in my collection, referred to above, was shot on a ledge on some rocky cliffs in Kotzebue Sound, where its nest was probably located.

The "white" gyrfalcons reported by Dr. Leonhard Stejneger (1885) as breeding in the Commander Islands were probably all *uralensis*, as birds from Bering Island, now in the United States National Museum, are referable to this race. He writes: "The White Gyrfalcon breeds on Bering Island, though in limited numbers only. A pair had their nest in a steep and inaccessible rock in the so-called 'Nakovalnaja,' a couple of miles from the main village."

Mr. Bull has succeeded in finding and collecting eight sets of eggs of this rare gyrfalcon in the region referred to above; five of these were collected in May, two in April, and one in June; the earliest was taken on April 22, 1934, and the latest on June 8, 1934, with large embryos; there were five sets of 4, two sets of 3, and one set of 2, with small embryos. He writes to me: "On May 13, 1932, my first set of eggs was taken from a ledge on a dirt bank overlooking a valley near Goodnews Bay. Other sets were collected in 1933 and 1934, when seven good sets were taken. At this time, a total of 14 nesting sites were known to me, but it was not practicable for one person to visit them all in a single season on account of the breaking up of the ice at this time. I believe that the beginning of nesting varies each year according to the weather. In 1934 we had a very early year, the break-up occurring on April 22.

"The nests were on ledges overlooking the bay, a river, or a valley. No addition was made to them except an occasional feather. If located on loose dirt ledges, a hollow was scraped. Frequently they were in nests formerly occupied by American rough-legged hawks. That the Asiatic gyrfalcon resents any intrusion upon its nesting domain there can be no doubt, and he who admires temperamental display can never forget the actions of a gyrfalcon disturbed at its nest."

Eggs.—According to the brief description of the eggs, given to me by Mr. Bull, these do not differ materially from those of other gyrfalcons. I have no measurements of them.

Plumages.—As this race is none too well known, and as no description is available in American publications, so far as the writer knows, it seems worth while to describe the known plumages in some detail. In general appearance this race is somewhat lighter and less gray above than *rusticolus*, much lighter and somewhat grayer than *obsoletus*, but decidedly darker than *candicans*. The wing formula given by the describers, fourth primary longer than first, seems to be very variable and unreliable as a subspecific character.

The Deering bird, referred to above, is in fresh juvenal plumage. The crown and nape are buffy white, streaked with "clove brown", and much whiter than the back; in *obsoletus* the crown is uniform in color with the back, or even darker; the rest of the upper parts is "clove brown", edged on the mantle and lesser wing coverts, and spotted, notched, or partially barred on the greater coverts and scapulars with pinkish, or buffy, white; there are broken bars of the same on the tail; the under parts are white, tinged with buff, with broad, elongated spots or streaks of "clove brown"; the inner webs of the primaries are deeply notched or barred with "light pinkish cinnamon" to white. In older immature birds the edgings have worn away and the buffy tints have faded out to white. At this stage the young are much like young birds from Iceland.

In fully adult plumage the crown is white to "pale pinkish buff", heavily streaked, especially posteriorly, with blackish brown; the mantle, scapulars, and wing coverts are "olive-brown" to "clove brown", more or less heavily, transversely barred with white, buffy white, or grayish white (not gray, as in European birds); the lower back, rump, and upper tail coverts are broadly banded with dark and light shades of "neutral gray"; the tail is broadly banded with "hair brown", or "fuscous", and gray mixed with white; the under parts are white, the throat and fore-breast pure white, except for a few narrow to almost invisible dusky shaft-streaks; the belly is spotted and the flanks are barred with sepia or blackish brown; the under tail coverts are barred with the same. Except for whiter heads and more white, less gray, in the barring on the mantles, these birds now look very much like adults from Europe.

Food.—According to Mr. Bull, the food of the Asiatic gyrfalcon, in the Goodnews Bay region, includes the local subspecies of both the willow and the rock ptarmigan, as well as lemmings, snowshoe rabbits, minks, and weasels.

Behavior.—J. A. Munro (1936) gives the following account of the behavior of one of these falcons that he observed in British Columbia, on December 19, 1935:

> I was motoring past a small brush-fringed creek in otherwise open country when someone shot at, and missed, a female mallard which then flew over the open range toward Okanagan Lake. A large falcon suddenly appeared and flying after the duck on the same level gained upon it rapidly, whereupon the duck swerved from its former straight course and the falcon shot past it. The duck then spiraled down to a small ice-covered pond where it alighted. The falcon flew swiftly toward the standing bird and in the next five minutes or so

swooped at it again and again, each time clearing the duck by a foot or more. After this it alighted on the ice about eight feet from the duck and remained there motionless for a few minutes. The mallard quacked continuously but did not move from its position. The falcon then rose and again began swooping at the duck. By this time my companion and I were walking toward the pond, one on either side and several hundred yards apart. When distant from the pond about 75 yards the mallard rose and flew toward Okanagan Lake and the falcon, passing close to my companion, was shot.

In the crop of the gyrfalcon were approximately two ounces of flesh from the breast of a male mallard, identified by the presence of the characteristic chestnut-colored breast feathers.

It is likely that the gyrfalcon was attempting to induce the mallard to fly, as the larger falcons seem to prefer to strike down their victims in the air, rather than pounce upon them on the ground; but, as these birds usually do not eat oftener than once a day, and as it already had considerable food in its crop, it may have been merely playing with the duck.

FALCO MEXICANUS Schlegel

PRAIRIE FALCON

Plates 5–10

HABITS

Contributed by Milton Philo Skinner

The prairie falcon is a close counterpart of the lanner falcon (*F. biarmicus feldeggii*) of Europe. It is also the prairie and desert cousin of the duck hawk, which it closely resembles with its pointed wings and its dash and courage, although it preys more on small mammals. Possibly this mammal-catching is due to the falcon's marked preference for the open spaces where the rodents live. In certain sections both the prairie falcon and the duck hawk occur, and there the two can be distinguished from each other by the uniformly lighter color of the falcons. The falcon is the same size as the duck hawk and larger than the American sparrow hawk, which it resembles in some of its habits. It ranges, normally, east to the Missouri River, occasionally to Minnesota and even to Illinois. It is particularly abundant in eastern Washington and Oregon and in the coast ranges that lie west of the great central Californian valleys. Yet, in California, it is seldom out over these level valleys but prefers the rough, broken foothills. This is easily understood when we find that the prairie falcon markedly prefers a nesting site in a cavity, or in a crevice, in the face of a cliff. Its range reaches only a little over the international boundaries into British Columbia and Alberta on the north and into the Mexican highlands on the south. At the present time it is rather rare over much of the range east of the Rocky Mountains, and it is steadily growing rarer everywhere.

Spring.—Throughout the more northern and colder parts of its range the prairie falcon is migratory, generally retiring toward the south to escape the coldest weather, especially in the Rocky Mountains and east. In the Yellowstone National Park I found them passing through on migration, appearing after March 25. Farther east, in northeastern Wyoming, they are rare, arriving usually about April 10 or 12, according to Peabody (1907). In Colorado, they are common in the warm months but all leave the mountains during winter. Still farther east they are seen occasionally in Kansas, Missouri, and the Dakotas; but south of these States prairie falcons are resident, except perhaps on the highest mountains.

Courtship.—Dawson (1923) gives an interesting account of the courtship of this falcon:

> About the brink of the precipice a dozen Falcons are at play. It is courting time and the birds are showing off. The females are the larger birds, but it is their turn to sit in the boxes while the aspirants perform. The doughty males are not really contending—only renewing their vows as they come hurtling out of the heavens, screaming like all possessed and cutting parabolas whose acuteness is a marvel of the unexpected. The female screaks in wild approval, or takes a turn herself because she cannot contain her fierce emotions. The rock walls resound with boisterous music, and the observer feels as though he were witnessing the play of elemental forces—riotous, exultant, unrestrained, the very passion of freedom and conquest.

Nesting.—Although the discovery of a prairie falcon nest is an event to be cherished, it is still more rare to see a pair hunting for a site. Harry S. Swarth (1904) tells us: "On April 6, 1902, Mr. Howard and I watched a pair flying about a rocky cliff in Ramsey Canyon. They were apparently in search of a nesting site for they flew into quite a number of caves and crevices in the rock, screaming shrilly the while, but on a later visit to the place we failed to find them."

In the open, rough sagebush country of California, Oregon, and Washington, prairie falcons choose for their nesting sites outcroppings of rocks, or cliffs, 50 to 400 feet in height and usually perpendicular. The sites chosen are generally 30 feet or more above ground and inaccessible to man, except by ropes from above. In the northeastern part of their range falcons are known to nest in the badlands of Montana, Wyoming, and western North and South Dakota, although rarely in eastern North and South Dakota. There are only a few records of *occurrence* in Minnesota and none of *nesting sites* (Roberts, 1932). A preferred site faces out over open country, and a southern exposure is often chosen, for the bright hot sun seems to cause no discomfort. Where there are neither cliffs nor crevices these birds will nest in all sorts of niches in any kind of wall, even in dirt banks. Consequently, while the average site is very characteristic, nests may be found almost anywhere. Decker and Bowles (1930) say that "in one nest we took a handsome set of five eggs after no more of an effort than simply walking to it and picking up the eggs, while others are placed under an 'overhang' of rock at such dizzy heights that we simply wished them good luck. In Washington they are, as a rule, less than sixty feet above the ground, forty feet being perhaps a fair average." In most cases the shelves or crevices used are natural, but in the soft material of dirt banks the birds may excavate a hollow of their own. Where they have a choice of sites falcons place their nests in recesses, or "pot-holes", varying from a few inches to several feet in width and penetrating into the walls from a foot to as much as 5 feet. Generally there is a projection above, protecting the nest. Although the species, as the name indicates, is prairie-loving, falcons are sometimes found where the mountains are quite heavily wooded. On the other hand, they do not nest on cliffs over the ocean as the duck hawks sometimes do. As a rule there is no nesting material whatever, the eggs being laid on clear sand or gravel, or amid bones, bits of fur, and feathers. Although falcons often use ravens' nests that are placed in niches in the rocks, they less often make use of ones placed on rock pinnacles, but Sclater (1912) says of Colorado birds: "Dille found a nest on the top of a chimney of sandstone in some buttes in the north of Weld county, on May 5th; it was an immense pile of rubbish, with skeletons and dead animals scattered round. * * * Gale took four eggs of this species from an old eagle's nest on April 24th, in a cliff on the Little Thompson River, the situation was about fifty feet from the bottom, and thirty feet from the top of the cliff, * * * another nest in a similar position on the St. Vrain." There is only one well-authenticated record of a falcon nest in a tree, even on the prairies, where cliffs are rare. Goss (1891) says: "At Marysville, Mo., [was] a nest in a tree, thirty-five feet from the ground; notes fail to show whether the nest was in the forks of the branches or in a hole in the tree, but doubtless in the latter." Since that record no further instances of tree-nesting have come to light. Mr. Bent noted a nest in a cliff at the top of a rocky hill in the Mojave Desert, San Bernardino County, Calif., saying: "When we yelled or clapped our hands the bird flew out from a little shelf on the side of a vertical crevice in the rocks. The eggs were in the remains of an old nest of a raven which had crumbled almost to dust, only a few pieces of sticks remaining, the eggs lying on the dirt in the center. Later, while I was at the nest the female made several close swoops at me within ten or fifteen feet; she was flying and cackling all the time." Generally these swoops are vicious in appearance and very trying to the collector's nerves, but almost always the falcon will, when within a few feet of the intruder, suddenly swerve to one side or the other. She does not have quite the nerve required for an actual attack, but Mr. Dawson (1923) says:

The assaults of an angry Falcon are really dangerous. Even when the earliest efforts are discouraged by a show of sticks or stones, it is decidedly disconcerting to feel the rush of air from a passing falcon-wing, upon your hatless pate, or to mark the instant change in pitch from the shrill uproar of impending doom to the guttural notes of baffled retreat. The Falcon has a nasty temper at best, and if she dare not vent her spite on you, she will fall upon the first wight who crosses her path. Woe betide the luckless Barn Owl who flaps forth from his den to learn the cause of the disturbance. I have seen such bowled into the sage in a trice. * * * At such times also the Raven is put on trial for his life. In spite of their close association, there is evidently an ancient grudge between these birds. * * * The Raven is an adept at wing-play himself, and the Falcon's thunderbolt is met with a deft evasion. * * * But the Raven takes no pleasure in it. His eyes start with terror, and while he has no time for utterance himself, the distressed cries of his mate proclaim the danger he is in.

The close association of Falcon and Raven at nesting time is the strangest element in the lives of both of them. To be sure, their requirements of nesting sites are similar; but it is more than that which induces the birds to nest within a hundred yards of each other in the same canyon, when neighboring or distant canyons offering as excellent sites are empty. So constant indeed is this association that when one finds the Raven's nest, he says, "Well, now, where is the Falcon's?" Of the entire number of Ravens' nests which came under my observation in one year, seven were thus associated with nests of the Falcon in the same canyon, and the remaining three were within a quarter of a mile of Falcons' in neighboring canyons separated by a single ridge. And it is impossible to tell from the stage of incubation which bird is the follower. * * * The only guess we dare hazard is that both birds reap advantages of warning in case of hostile approach. Concurrent with this association is the annual, or at least occasional, shifting of sites on the part of both species.

* * * This shifting is of course quickened by persecution. If unsuccessful in raising a brood one year the bird will try another situation, but always, except in extreme instances, in the same canyon or general locality. In this way the Falcon appropriates the site once occupied by Ravens (and so gets credited with a "stick" nest, though I am satisfied that the Falcon never lifts a twig); and the Ravens, in turn, without opposition, are allowed to rear their pile in a niche just previously occupied by the Falcons.

Decker and Bowles (1930) write that while potholes—

are perhaps the favorite nesting sites of these birds, they are by no means the only kind selected. In many cliffs there are no potholes at all, but on some projecting ledge of rock a Western Red-tail or a Raven will have built its nest during some past season, and it is the old nests of these two species that are very commonly used by the Falcons. In fact, in many localities the abundance of the Falcons as breeding birds depends entirely upon the presence of the old nests of these other birds. An instance by way of proving this statement occurred to us in the past spring when we visited a cliff where the year before we had found a Falcon using an old Raven's nest. The nest had been dislodged by the winter storms and, as there were neither old nests nor potholes, there were no signs of the Falcons to be found anywhere in the vicinity. This is only one case in several that we have noticed. In our experience the Falcons will always return to the old nest, even though the rightful owners wish to take possession themselves. A very interesting example of this was given us in the past spring of 1928, a somewhat detailed account of which may be permissible. The nest in question was that of a Western Red-tail, which was situated on a ledge about twenty-five feet from the ground and some forty feet below the top of the cliff. We had taken a set of three eggs of the

Hawk from this nest in 1926, and in 1927 we had found it occupied by a Falcon with five eggs. Going to it in 1928 we at first thought it deserted as no bird could be seen, but, upon going directly beneath it and shouting, the Falcon flushed with her customary fierce challenge. Much to our pleasure the nest contained five eggs of the Falcon and, to our great surprise, one egg of the Red-tail, all of which were perfectly fresh. The poor Hawks had been through a very hard spring, as they had built a nest about half a mile distant across the river and had their eggs eaten by Ravens. Of course we had no means of ascertaining the course of events, but it would have been most interesting to know if the Hawk had laid its egg before or after the Falcons had taken possession of the nest. It is highly probable that the Falcons could and would drive away the rightful owner, if they wished to do so, even though the Hawks had taken possession first. However, on the other hand, it seems highly possible that the Ravens had destroyed an incomplete set in the new nest and the Hawk had then taken advantage of a temporary absence of the Falcons and laid the egg to complete her set in her nest of a former year.

The friendly relationship existing between Falcons and Ravens, that are both nesting in the same cliff, is nothing short of astounding, especially when we consider that a Raven is perhaps the most "dyed-in-the-wool" egg eater in the animal kingdom. It is fairly safe to say that in seven cases out of ten a pair of Ravens will be nesting in the same cliff that is occupied by a pair of Falcons, the nests in many cases being only a few hundred feet apart. Yet strangely enough we have never seen a sign of friction of any kind existing between the two species. When we first commenced our studies of these birds we always were fearful that the Ravens would eat the Falcon eggs before the set was complete. However, this has never occurred in all the many instances that have come under our observation, the Falcons paying little or no attention to the Ravens at any time. The reason for this may, perhaps, date back to some past generations of the Ravens who learned through bitter experience that it was far the wisest thing to make the contents of a Falcon nest the exception to their general rule of eating eggs and baby birds. Perhaps this knowledge has been inherited by the present generations. One thing absolutely certain is that the Falcons "rule the roost" and do exactly as they please in the selection of nests, the poor Ravens simply taking what the Falcons do not want and making the best of things. As a rule the Ravens lay their eggs about a week earlier than the Falcons, but the latter have apparently already selected the nest they want and the Ravens usually build a new nest for their first set. If the contents of the nests of both species are removed they will usually lay again in the same nests, but they occasionally trade nests * * *. Yet in all this switching around we have never seen any signs of discord between the two species, trying as it must be on their tempers.

John G. Tyler (1923) says:

In the region where my observations have been made the north end of the ridges breaks off abruptly into cliffs and for that reason most of the nests I have examined have had a northern exposure. A few have been on west-facing cliffs and one faced the east or northeast, but none has been on ledges with an outlook to the south. Of seventeen nests personally examined during the past few years nine have been in pot holes of various sizes, where the eggs rested on the gravel and small loose rocks which lined the cavity. Six sets were laid on the tops of nests built by ravens and these nests were utilized without any alterations whatever. In one case, the nest was newly built and freshly lined with wool, while the other five were in various stages of disrepair. One pair of falcons used, during three seasons, a hole in which a pair of ravens had evidently built a nest many years before.

The female does the brooding, although the male will sometimes take her place under unusual conditions. Usually the male, unless hunting, will perch on a tree somewhere near the nest. Decker and Bowles (1930) say that for some reason she will remain with the eggs when in an open nest almost to the last extremity, "while in one of the pot hole nests she may flush at some little distance." They continue:

> The period of incubation does not seem to influence her actions in this respect to any great extent so far as we have seen. We had one most fascinating exhibition of a close sitting bird at one site where an old nest of the Raven was used. One of us was walking along the top of the cliff, while the other walked along at the base, the man at the top being considerably further in advance. Presently a nest was sighted at very close range with the bird crouched upon it and most intently watching the man below her. The man at the top made very little noise and she had not seen him, so he had a perfect opportunity to study her. She flattened herself down into the nest so far as to be completely out of sight from any direction excepting directly above and remained in that position until the man below was almost up to her. Then she stood up in the nest and commenced her battle cry that gives such a never failing thrill to the bird lover, not leaving until she knew it was useless to remain any longer.
>
> In its action around the nest we have never known a Falcon to actually strike a human being.

Between the "close sitters" and the wary birds there are all gradations. After the female has been driven from her nest, she will seldom return to her eggs while the enemy remains in sight. Should the intruder suspend activities and remain quiet, she may perch more or less nervously on a tree not too far away; but renewed movement will often bring her back to scream and swoop. She is evidently the more aggressive and the more concerned over the eggs. The male usually contents himself with circling high overhead.

Throughout most of its range this falcon is a valley or foothill bird, so that it comes as a surprise to hear of its hunting, and even breeding, far above timberline. Merriam (1890) says: "A pair of these Falcons had their nest on a high cliff in the crater of the main peak of San Francisco Mountain, and another pair had possession of a similar ledge on Kendrick Peak." Both of these locations were at least 11,000 feet above sea level. Bergtold (1928) says that in Colorado the prairie falcon "breeds up to 10,000 feet." Lowe (1895) says that "one was shot at 10,000" in the Wet Mountains, Huerfano County, Colo. Dr. E. A. Mearns (1890) saw one on June 4, 1887, at the very tip of Humphreys Peak, Ariz., at 12,562 feet, and writes: "These only braved the wind and cold at the summit. The name of 'Prairie' Falcon scarce accords with my recollection of that scene."

Eggs.—Usually there are four or five eggs to a set in California, Oregon, and Washington. Records of just 100 sets collected in these States show 7 percent contained three eggs, 21 percent four eggs, 70 percent five eggs, and 2 percent six eggs. But four sets obtained farther east in Wyoming and Colorado showed one set of two eggs, one of three eggs, one of four eggs, and one of five eggs. Therefore it is presumed that eastern nests have fewer eggs. Additional sets of two eggs have been taken, even in California; but in these cases the sets were incomplete or second sets. Bendire (1892) says that the "eggs are laid at intervals of a day or two."

Tyler (1923) says:

> The eggs from any one pair of birds bear a close resemblance from year to year and it is always possible to tell, by the eggs alone, when a new female takes possession of a nest.
>
> I have never made a practice of taking second sets, but I have determined that a second set is nearly always laid within a period of from twenty to twenty-five days after the first set has been removed. Usually the same nest is used, although sometimes the birds move to another site which, as a rule, is in the same cliff or in one not far away. * * * Undisturbed birds raise but one brood of young each season. Moreover, I am inclined to believe that certain pairs occasionally pass a season without nesting, as I have, on two different occasions, found both birds present at a nest site, yet their actions did not indicate that they were nesting and on subsequent visits they showed no active interest in the neighborhood.

Prairie falcon eggs are somewhat smaller than those of the duck hawk and average lighter in color than the eggs of any falcon except the American sparrow hawk. The eggs are very handsome and, since they vary a good deal in color, are attractive to collectors. According to Mr. Bent's notes they are ovate to nearly oval, finely granulated to smooth, and often pimpled. The ground color is white, creamy white, or pinkish white. About half the surface is finely and evenly sprinkled with minute dots, nearly or quite concealing the ground color; the other half is more openly spotted with larger spots that are sometimes concentrated at one end; sometimes there is a broad wash of color at one end, and sometimes the overlying color even obscures the ground color so that the whole seems "vinaceous-cinnamon." The markings are "burnt sienna", "amber-brown", "tawny", or "cinnamon." These three ground colors and the four overlying ones are capable of many combinations. Since the markings also differ in shape and distribution, prairie falcon eggs are subject to a wide variation in appearance. Very rarely an egg will show a uniform color all over. One beautiful tint is a purplish shade noted by Coues (1874) and by Dawson (1923) but even better described by Truesdale (1910).

The measurements of 331 eggs, from all sections, average 52.3 by 40.5 millimeters; eggs showing the four extremes measuring **57.9** by **42.7** and **47.1** by **36.0**. The largest egg came from Sweetwater County, Wyo., but one only a trifle smaller was collected in the State of Washington.

Young.—Bailey and Niedrach (1933) reached a nest in Colorado just as the eggs were hatching. They tell us that they used a photographer's tent as a blind, and, although the female falcon was suspicious of the blind, especially of the bright lens, she came back to her nest again and again. The last time, the motion-picture camera was started as she approached, "and in a few moments she alighted as before. Motionless, with wings dropped, she looked at the blind, and finally, apparently satisfied that all was well in spite of the whirring noise, settled down upon her eggs." On the following day two downy young sprawled on the rocky shelf. The mother returned in half an hour to cover the falconets and the other two eggs.

When the young falcons first leave their eggs they are as helpless and ill-formed as any birds could be. During the following five weeks they are carefully looked after and fed by the female parent. They grow rapidly, and at the end of this period they leave the nest and are soon able to care for themselves. Taverner (1919a), however, distinctly noted that the young, after leaving the nest, "while full-fledged and apparently strong on the wing, were under parental care."

Although we have many accounts of finding the nests and of securing the eggs, with whatever habits could be noted at the time, only one scientist, that I know of, has had the time and patience to make a detailed study of the brooding, care, and growth of the young. F. H. Fowler (1931) made this study in 1928 in the canyons of the eastern side of the Mount Hamilton range of mountains in California. The nest that he designates as Nest no. 1 on April 29 "was found to contain five young falcons, about nine days old, according to subsequent weight comparisons. [Full set of eggs was found April 1.] Nest number 2, which could not be visited until May 6, then contained four very young birds, believed, after much subsequent study and figuring, to average about three days old. [Full set of five eggs was found April 1.]" Mr. Fowler continues:

> They were weak, had a marked tendency to capsize, and when they did roll over immediately curled up as if still in the shell. Only the most advanced had their eyes part way open, and the others showed very marked and extensive granulation around the unopened eyelids. No remnants of the fifth egg, nor of a chick hatched from it, could be found.
>
> The young in nest number 1 were systematically weighed and photographed in the nest, until the family took to wing some time between May 23 and the next visit on May 30. Those in nest number 2 were weighed, and a selected bird photographed to scale, until they appeared ready to leave the nest when last visited June 6.

The weights of a typical young falcon are as follows (condensed from Fowler's diagram):

May 6, 1928	3 days old	weighed 2½ ounces
May 13, 1928	10 days old	weighed 7½ ounces
May 20, 1928	17 days old	weighed 14 ounces
May 30, 1928	27 days old	weighed 20 ounces
June 3, 1928	31 days old	weighed 19 ounces
June 6, 1928	34 days old	weighed 18 ounces

Weights taken at nest number 1, when adjusted to compensate for age, and for full or empty crop, correspond closely with the longer and more complete record taken at nest number 2, and are therefore not here included.

* * * This pair [nest no. 2] were mighty hunters, remarkable for the variety of their quarry. They also had the habit of bringing in their game intact to the nest, or to a small shelf near the base of the cliff, and there plucking the birds and leaving the remains, after satisfying the ravenous family and their own appetites.

This habit is rare, I believe. Usually the mammals are torn into and partly eaten before being brought to the nest to feed to the young. When the feeding is about completed, the parent lifts the remains in its beak, makes a running start, and on the instant of taking wing shifts the remains to its talons. On some rocky point in the vicinity it then probably cleans off and eats the scraps of meat from the skin and bones, and leaves them where they are never found for record. The larger birds are ordinarily partially plucked before being brought to the nest, and the fag ends are probably carried away at the end of the feast. Smaller birds disappear on the spot as if by magic. This habit of carrying remains away was observed from the blind in 1930 * * *.

It is difficult or impossible to estimate definitely the number of animals represented by a given numbers of pellets from a nest. All the young may receive a full crop of fur from a single large ground squirrel. In a family of five, such as that at nest number 1, this meal might result in five pellets available for analysis from the death of one animal. On the other hand, five pellets found at the roosting place of a mature bird would almost certainly have meant at least five animals killed. * * *

After the photograph and movie campaign of 1930 had been completed, four pellets were found on the edge of the mesa, just behind the old bird's lookout rock across the cañon; none was found at the base of the rock. These pellets measured 2.00 x 0.80 in.; 2.12 x 0.88 in.; 1.82 x 0.90 in.; and 2.10 x 0.90 in.; they are notably more compact and symmetrical than those of the young.

Observation of falcons in captivity coupled with the fact that these wild birds deserted their lookout point for the firmer footing of the flat mesa shows that the process of casting up a pellet is a serious and sea-sick business. When the symptoms of "casting" first attack a falcon it draws its feathers down flat, stands up full height, sticks its head and neck outward and upward, and for a few moments looks bereft of its senses. It then starts to duck its head in a series of quick jerks, at the same time contorting its neck violently from side to side. This muscular action appears to force the relatively large pellet from the bird's interior upward into the crop. The sidewise contortions then cease, and the pellet is cast by a series of up and down pumpings of the head and neck. The bird then stands for a few moments seemingly with the sad question in its mind—"Would a good dose of Mothersills have obviated all of this?" It then shakes itself, resumes its interest in life, and begins to wonder where the next supply of fur and feathers is available. * * *

Probably a definite weight of meat (with comparatively little variation one way or the other) is required to develop a young falcon from the egg to the day of flight. Whether this food supply consists of tender birds or tougher rodents probably makes little difference in the total weight consumed. However, toward the end of the nest life the demands of the family are so tremendous that an endless stream of mammals and fair sized birds seems to be the only recourse of the hard-working parents. Small birds could hardly be caught fast enough.

The food actually secured probably depends to a large extent on the locality, the season, and the individual hunting ability of the parents. In the general locality of these studies ground squirrels and meadowlarks (being the most readily available source) probably form a large part of the normal supply of the

> average falcon family. Here, and elsewhere, it is probably more difficult for the parents to raise a brood hatched a month late than one hatched at the normal time. The hunting ability of the parents is a prime factor in at least the variety of the food supply.
>
> Only by observing a large number of families can a true estimate of the falcon's economic status be established.

Mr. Fowler (1931) also gives the following data in detailed tables: At Nest no. 1 a partial tabulation showed that 1 California horned lark, 8 western meadowlarks, and 9 California ground squirrels were eaten between April 29 and May 20, 1928. At Nest no. 2 it was possible to make much fuller tabulations, showing 2 mourning doves, 8 burrowing owls, 3 California horned larks, 9 California jays, 15 western meadowlarks, 3 Brewer's blackbirds, 2 California shrikes, 1 rock wren, 1 poultry, 1 unidentified bird, 1 California pocket gopher, 7 California ground squirrels, and 1 Nelson spermophile eaten by four young between May 6 and June 6, 1928. The poultry item was "one small white wing about the size and shape of a meadowlark; probably a Leghorn chick from a neighboring ranch", but a detached wing might have been picked up so far as data show.

Speaking of a nest in Montana, Cameron (1907) says that a pair of Say's phoebes that built a nest "in a hole near the Prairie Falcons' eyrie were killed by the latter for their young."

Plumages.—Falconets just out of the egg, or at least as soon as they are dry, are covered with fine white down. When the birds are about two weeks old the darker feathers of the tail and wings become noticeable, and a few days later various feather tracts on the body outline themselves. At about four weeks of age, the feathers are well started. During the following week the feathers grow so fast that the bird actually loses some of its body weight, although ample food may be greedily swallowed. The changes in color are rapid, so that a young bird five or six weeks old is really darker above than the adults. Although this coloration is rich, it is still obscured until the shedding of the last down at some two months of age. The final growth of plumage and the last shedding of down take place after the young are on the wing. The young falcons out of the nest are buffier and more striped than the adults, with a more reddish tinge to the upper parts; the iris is brown; the feet and legs are slate color; the claws, black; the bill, bluish black, with the base of the under mandible yellow. It is not known just when the changes are completed, but gradually the juvenile plumage becomes lighter, clearer, and more like the adult. The feet and legs become yellow, while the mandibles and iris change little, if any. Bailey and Niedrach (1933) write:

> Out came the female falcon. And, what a bird! Niedrach had promised a surprise, but such a beautiful hawk was not expected. Instead of the natural brown plumage of the species, this bird was cream white, with occasional markings

> of the natural dark color. She hovered overhead, shrieking her displeasure at the invasion, and, even at that distance, her black eyes contrasted with her light-colored feathers. Niedrach has known that particular bird for nine years. She had nested in the vicinity each year, but he had never been able to reach her nest to photograph it, and, in that time, he had never seen other light-colored falcons, with the exception of one young bird, which had a white feather in the center of the back. Apparently, the young were usually of normal plumage. [Pl. 10.]

Like most hawks, the adult prairie falcons may exhibit either light or dark phases of plumage, with all gradations between the two extremes. Although it is probable that this species molts at least once a year, nothing is known about the time or the manner. Neither is it known positively whether there is only one molt each year or more.

Food.—While I was examining reports on the food habits of this falcon, from various sections of its wide range, two things became very evident: First, no adequate study of the subject has ever been made, and we are therefore mostly dependent upon various items picked up incidental to oological, or other, studies; and second, these incidental notes show great diversity of food, possibly due to difference in range, availability of certain victims, opportunities of the observer, and changing conditions as affected by man. All agree that this falcon is bold and enterprising and fully capable of easily killing prey even larger than itself. No doubt the ease and certainty of securing a stated prey are responsible for a seeming preference for that prey in that locality; otherwise, food is normally quite varied.

In places where there are large flocks of these small birds, the prairie falcon preys on sparrows and Brewer's blackbirds, more or less harrying the flocks as long as they remain in the vicinity. Its powers of flight are great enough to permit of the successful chase and capture of mourning doves; and in places it takes meadowlarks in numbers. Speaking of central California, Tyler (1923) says: "My personal observations have convinced me that small birds are preferred at all times * * *. From the time the falcons return to their nest cliffs in early spring through the egg laying and incubation periods the Gambel Sparrows (*Zonotrichia leucophrys gambeli*) are very abundant in the regions where falcons abound and a very heavy toll of sparrows is taken. But, by the time the young falcons have appeared, these sparrow hosts have practically all migrated and the falcon turns his attention to Western Meadowlarks, Valley Quail, and Western Mourning Doves." Most of the falcon's hunting is done early in the morning and late in the afternoon, even in cloudy or comparatively cool weather. Dawson (1923) says:

> The bird makes little fuss over the capture of small game. It simply materializes out of the empty blue and picks up a gopher or a blackbird as quietly as you would pluck a flower. The approach has doubtless been nicely calculated. The thunderbolt, launched from the height of half a mile, has been checked every few hundred feet by a slight opening of the wings, that the Falcon might gauge the

> caliber and the intent of the victim; and the final plunge has, therefore, the speed and accuracy of fate. In case of larger game the quarry is knocked headlong by a crashing blow, after which the assailant turns to try conclusions as to weight. But the Falcon prefers always to snatch, and when small game is abundant, the bird is less likely to disturb rabbits or poultry.
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> * * * While his visits to the poultry yard are by no means rare, and his offenses, judged from this narrow human angle, are serious, we shall not stop to plead the thousands of destructive squirrels which this bird accounts for.

Henninger and Jones (1909) say: "They seem to prefer bird flesh, but during a scarcity of such diet may be driven to any of the smaller animals." On the other hand, Decker and Bowles (1930) say that during the nesting season young rabbits are preferred, probably because of abundance; but stomach examination indicates change of diet in winter. Mr. Ridgway (1877) says: "Late in November, of the same year [1867], it was noticed again among the marshes along the Carson River, near Genoa, where it was observed to watch and follow the Marsh Hawks (*Circus hudsonius*), compelling them to give up their game, which was caught by the Falcon before it reached the ground; this piracy being not an occasional, but a systematic habit." But Cameron (1907) says that a golden eagle in Montana seemed to play a somewhat similar trick on a prairie falcon: "On September 21, 1904, at our ranch in Dawson County, my wife and I watched a Prairie Falcon in the act of carrying off a Meadowlark which was screaming and struggling in its talons. As the falcon rose level with the hill-tops, a Golden Eagle sailed majestically over in close proximity to it, thereby appearing to fluster the other which allowed its victim to escape."

In the Yellowstone National Park I once saw a prairie falcon make several swoops at a flock of 44 Brewer's blackbirds, although on that occasion they all escaped into the thick foliage of some big pines. Ellsworth D. Lumley writes me in a letter: "On November 16, 1932, I witnessed a prairie falcon eating an English sparrow in this city [Great Falls]. Another falcon sat in a nearby tree and gave its piercing cry." But Lumley also writes that on October 18, 1932, a falcon stomach was found to contain a pellet of hair and some small bones, indicating rodent diet. Goss (1891) says that he saw a prairie falcon "dart from a telegraph pole into a flock of chesnut-collared Longspurs, and knock down four of the birds at a single dash, killing three and winging the other." Fuertes (1920) adds "jays" to the list of falcon prey. Mrs. Bailey (1928) writes that the prairie falcons were "about the alfalfa fields at Carlsbad [N. Mex.] in September, apparently looking for game among the flocks of waders that followed the irrigation of the fields. When the waders were quietly feeding, the appearance of this dark, short-necked hunter would send a big flock of the silvery birds into the sky, or if he dashed in among them, would put them to disorderly flight." Mrs. Bailey, quoting Dr. Wetmore, also says that "they harried the Yellow-headed Blackbirds so mercilessly that they set up an outcry whenever a bird of any size appeared on the skyline." Strange, indeed, seems the incident witnessed by Pemberton and Carriger. They (1915) write that a prairie falcon was seen on May 27, 1909, "to sail into a flock of sea gulls flying near the beach and strike one of them to the sand. After performing the trick the bird flew away, evidently not caring to eat his prey."

We have already spoken of the prairie falcon taking doves and valley quail, but it also preys upon many other game birds as well. Willard (1916) says that they take considerable toll from the flocks of band-tailed pigeons. "These terrors of the air will dash into a tree and grab a pigeon off a branch, rarely making an unsuccessful raid." Still, because this falcon prefers open country, its raids fall more severely on game birds of the open, such as valley quail and Gambel's quail, and it has found the newly established European partridge a choice morsel. Munro (1929) says: "The present relative abundance (the species is by no means common) is perhaps due to a recent increase of European Gray Partridge which these falcons hunt persistently. When a Prairie Falcon passes along one of the open hillsides frequented by these birds coveys rise in every direction. No better aid in estimating the partridge population of a hillside could be devised."

Even the sharp-tailed grouse is not too large a quarry. Bendire (1892) says that he found "the remains of a Columbian Sharp-tailed Grouse in the crop of one specimen." E. S. Cameron (1907) and Henninger and Jones (1909) mention this grouse as prairie falcon prey, without giving further particulars. Goss (1891) cites both ducks and prairie chickens as victims. When the boldness and audacity of this falcon are considered, it does not sound strange to hear that it will catch ring-necked pheasants at a game farm. Jewett (1926) says: "On November 24, 1925, at the Oregon State Game Farm at Corvallis, Oregon, one of the farm employees shot an adult female *Falco mexicanus* that was in pursuit of a female Ring-neck Pheasant. * * * This is the first Prairie Falcon to be seen there, and only the second record of the species in the Humid Coast Belt of western Oregon of which I have knowledge." Mrs. Bailey (1928) also speaks of this habit: "A Ring-necked that was once attacked by one was so terrified that, at each swoop of the Falcon, it would flatten itself against the ground."

In addition to the upland game birds, prairie falcons sometimes attack water birds. Decker and Bowles (1930) say: "A large female at Santa Barbara, California, had killed a Coot (*Fulica americana*) with which it tried to fly across the road." E. S. Cameron has known the prairie falcon to prey upon mallards and both kinds of teals. He (1907) says: "At the time of their migration Green-winged

Teal seem to be a favorite quarry and Mr. J. H. Price has twice shot one of these ducks from a flock pursued by a Prairie Falcon before it had made its stoop. This dashing marauder attends upon the Teal as they move up and down the creeks." From such a list as this, with so many game species upon it, it would seem that the prairie falcon is a great destroyer of birds. The fact is that all the incidents given here are exceptional, although interesting because they illustrate the prowess of some individual prairie falcons. Grinnell, Dixon, and Linsdale (1930) actually say: "Feeding ducks and coots at Eagle Lake appeared to pay no attention to hunting Falcons. It was thought that in that vicinity this species hunted for meadowlarks and flickers."

I believe, also, that prairie-falcon attacks on poultry are unusual occurrences. Although I have searched the literature about this species, I find only the following records, and these include both specific instances and general statements based upon evidence unknown to me. Baird, Brewer, and Ridgway (1905) say: "Dr. Suckley procured a specimen at Ft. Dalles in the beginning of winter, 1854–5, caught in the act of carrying off a barn-yard fowl of about its own weight, and which it had just seized near the door of a dwelling-house." Ridgway (1877) notes: "In the Truckee Valley we saw one snatch a young chicken from a door-yard, in the presence of several spectators." Merriam (1891) records one shot while "in the act of chasing a chicken in the lower part of Birch Creek [Idaho], August 7 [1890]; its stomach contained a Horn Lark (*Otocoris*). But they "were often seen chasing Teal up and down the creek." Cohen (1903) adds: "One attacked a band of half grown turkeys early in the fall and the other flew from an oak at some pigeons inside their enclosures and struck the wire netting." Peabody (1907) says: "As is well-known, this Falcon is a terror to poultry." Cameron (1907) notes: "The Prairie Falcon is very bold in its attacks upon game birds and poultry * * *. In attacking full grown hens the falcon suddenly checks its stoop about a yard above the victim over which it hovers before making the final dash. Meanwhile the shrieking fowl runs wildly about and there is often time to scare away the freebooter which then mounts with incredible rapidity." Truesdale (1910) writes: "Their food consists chiefly of small mammals, birds and occasionally chickens which they catch. * * * I have seen this falcon fly into a flock of chickens and strike one * * * returning again and get another one in the same manner, until they have killed off nine chickens." Vernon Bailey (*in* Florence Merriam Bailey, 1902) says: "The falcons are bold freebooters when a farmyard happens to lie in the valley below and their hungry young are calling, but ordinarily ground squirrels and other small rodents supply most of their food. The few birds they get are mostly caught on the wing. One that shot past me in pursuit of a flock of Gambel quails in southern

Utah struck a quail from the flock with such force as to knock it to the ground amid a cloud of feathers, but fortunately for the quail it landed in the brush, where it escaped." H. S. Swarth (1924) records: "Once observed in pursuit of domestic pigeons in Flagstaff, and several times after poultry about ranch houses. The one specimen preserved was shot while making off with a chicken." Tyler (1923) adds: "October 24, 1912, near Fresno I saw, at close range, a falcon which was circling overhead suddenly fold his wings and swoop at a small white chicken in a barnyard. The chicken escaped by quickly diving under a clump of shrubbery." Finally, Ellsworth D. Lumley writes us: "On the May 13, 1933, trip I came into possession of a prairie falcon that a woman had killed the day before. It was in the chicken yard with a chicken in its talons and when approached allowed the woman to come close enough to knock it out with a rock." But, on the other hand, Bendire (1892) bears contrary testimony for the prairie falcon: "Poultry was rarely molested; and although one of these Falcons would sometimes make a dash at some of the fowls, it seemed to me that it was done more to scare and to see them run than to capture them. Not a single instance came under my observation where a chicken was actually struck by one of them. I have no doubt whatever that they are fully capable of killing a full-grown hen and of carrying her off, but they do not seem to care for poultry, and I have more than once seen chickens feeding under a tree in which one of these birds was sitting." In many ways I consider Mr. Tyler's article (1913) particularly illuminating when he writes: "A farmer living near New Hope once told me of a long-winged 'bullet-hawk' that made regular visits to his place in quest of young chickens, which it seized and bore away so rapidly that he could never prevent the loss. Finally he resolved to wait for the robber, as it always appeared about the same time each day, coming from the foothills of the Coast Range mountains, fully twenty-five miles away, and returning toward the same place. * * * At the shot the bird dropped its victim [a squawking young fowl] but continued its flight, although apparently much weakened. It was never seen again." There are scores of falcons in these same Coast Range mountains. If chicken-killing is at all common, why did not Mr. Tyler hear of, and record, other instances? That this was simply one and the same individual that had developed a taste for chicken seems shown by the fact that it never returned after being shot at once.

While all ornithologists are naturally more interested in falcon attacks on birds than on mammals and are more likely to note such instances, there are many notes of mammal destruction by prairie falcons. Goss (1891) says that they kill "mice"; Bendire (1892) and Henninger and Jones (1909) list "rodents"; Bryant (1918) adds "pocket gopher"; Coues (1874), Goss (1891), Fisher (1907), Tyler

(1923), Dawson (1923), and Hix (no date) all record "ground squirrels" of various species; Cooper (1870), Ridgway (1877), Goss (1891), Bendire (1892), Henninger and Jones (1909), and Sclater (1912) specify "hares" or "jack rabbits"; Decker and Bowles (1930) say that their food during the nesting season, "so far as we have seen, consists almost entirely of cotton-tail rabbits and young jack rabbits"; while Sclater (1912) adds "prairie dogs" to the mammal list. Bailey and Niedrach (1933), operating in Colorado, give us more details: "A few minutes later, we saw the falcon darting low over the homes of the prairie dogs. He dipped close to the earth and struck one of the rodents scurrying for cover, and, with scarcely slackening speed, mounted into the sky with a young prairie dog dangling from his talons. He circled higher, as though to look us over, and then flew to a pinnacle of rock where we could see him tearing at his prey." As said before these falcons can kill prey larger than themselves, and this is particularly true of the jack rabbits that are fully twice as heavy as their destroyers.

So it seems evident that many of us know only a part of the story. Unfortunately, only one study of the food of the prairie falcon has been made, so far as I know, and the details of that are given under subheading "Young" (p. 24). It is a good account, but it shows us that there is much more to be learned about the food of these birds. Strange to say, when we consider the prowess and strength of the prairie falcons, there are several records of lizard and insect eating. Fisher (1893b) says: "Lizards are occasionally taken, and, among the insects, the large crickets and grasshoppers which are so abundant in some sections of the West are also eaten." Goss (1891), also, lists lizards as one of the items of food, but does not speak of insects. Taverner (1926) says: "On occasions it even turns seriously to grasshoppers and the crop of at least one specimen examined by the writer was filled with these insects. Of eight other stomachs examined, 3 contained game birds; 5, other birds; 2, mammals; and 2, insects." Tyler gives an interesting account of a prairie falcon hunting on the ground. He speaks of the probability that it was after a jack rabbit; but, to me, it seems very likely that it was after rodents or insects. I have personally seen them hunting grasshoppers in just that way. Tyler (1923) says:

> That this species sometimes seeks its food in much more lowly manner than one would expect is evidenced by an incident which came to my notice on January 13, 1920, near Hughson, Stanislaus County. I was sitting in an automobile talking with an acquaintance when I noticed a Prairie Falcon on the ground in a large grain field. * * * He was hopping over the ground and seemed to be carefully looking at the many small bunches of stubble which had accumulated as a result of the recent plowing of the field. The falcon was repeatedly seen to hop up onto small clumps of this straw, and scrutinize them carefully as if in search of

> any small bird which might be concealed therein. After satisfying itself that no prey was to be found, other straw heaps, in turn, were visited. Fully half an acre of ground was covered, but the falcon was not seen to capture anything. * * * As I left the field, * * * it sprang into the air and beat away on strong wings. As the falcon began to gain speed a jack rabbit sprang from its place of concealment, whereupon the falcon made a very swift and graceful swoop toward the rabbit but did not appear to endeavor to strike it.

Giving due consideration to all the cross currents noted in the lives of various prairie falcons, we begin to wonder just what their economic value to man may be. The most serious complaint against them is not that they kill chickens, but that they destroy tame pigeons. Often a single falcon will hang around a grain elevator to catch the tame pigeons coming there for waste grain. At times, a falcon will locate a pigeon cote and visit it more or less regularly until it has taken every bird. But, even this pigeon hunting seems to be more or less individual, and is not at all a general habit.

Probably the destruction of poultry, pigeons, and wild birds by prairie falcons is pretty well balanced by the good the falcons do in destroying so many noxious rodents. Dr. A. K. Fisher (1893b) writes: "At present the data we have on the food of this Hawk is not enough to decide whether the species should be protected or persecuted." Later, although still undecided, Dr. Fisher (1907) sums up the evidence well, saying:

> Throughout a large portion of the country inhabited by this species, poultry is scarce, as most ranchers do not yet attempt to raise it. Although this falcon feeds extensively upon waterfowl, quail, prairie chickens, and other game, it attacks also various kinds of injurious mammals, notably the smaller ground squirrels, such as the striped, Franklin, Richardson, Harris, and the allied species, which abound in many sections of its range. In this respect it is of considerable service to the agriculturist, and probably offsets the injury done by destroying game; but, unfortunately, the data at hand are insufficient to show just how extensively it preys on these animals; hence the benefit done cannot be correctly estimated.

Richard M. Bond (1936b) says: "At an eyrie in southwestern San Luis Obispo County was found a fresh half-eaten wild cat (*Lynx rufus californicus*) kitten, the estimated live weight of which was slightly over 2 pounds, or about the load limit of a female Prairie Falcon. There is no proof that the kitten was killed by a falcon (it was on a ledge about 30 feet from the nest), but a rather extensive exploration of the cliff disclosed no signs of other large birds of prey."

Behavior.—To use the wording of the hawking brotherhood, this is a noble bird, met with far out over the wild, lonely foothills, over the unsettled plains and prairies, and even over the deserts of the Southwest. It is strong, bold, and a fearless fighter, but wary, shy, and secretive where it has been subjected to molestation. Like most other hawks it likes to sit on dead trees and other conspicuous perches that will give it a wide outlook over the domain that it considers its own. Although it is normally a resident of the Sonoran Life Zone, some individuals nest, as in Colorado, almost up to the tops of the mountains; and many of the lowland birds climb to the highest altitudes as soon as the nesting season is over.

While individuals vary, most nesting prairie falcons react as Mr. Bent records: "While I was at the nest the female made several close swoops at me within 10 or 15 feet. She was flying around and 'cackling' all the time. Meanwhile, the male was flying around at a safe distance." S. F. Rathbun writes that when he approached a nest "the falcon flushed from the nest and gave three shrill cries, and immediately its mate came to the scene. Meanwhile my friend was working his way up the side of the crevice in the wall. The pair of falcons dashed back and forth, the one that flushed diving at me repeatedly, at times coming within 10 feet of my head, and both gave their cries so loud I think they could be heard nearly half a mile."

Bailey and Niedrach (1933) tell us:

> As we walk along the edge of the dog town, near the steep escarpment, a great winged eagle sails out into space from a spot of shadow, where he had been resting unobserved, and flies leisurely along, and then while we admire the beauty of his flight we are attracted by a shrill scream of displeasure overhead, as a medium sized falcon darts with the speed of an arrow at the slow moving eagle. The latter's movements are no longer leisurely, however. He immediately puts on all speed, and with the unwelcome falcon swooping in vicious onslaughts from the rear, much as a small terrier would snap at the heels of a lion, the great bird makes an undignified and hurried exit from the vicinity.

Decker and Bowles (1930) had a still more entertaining experience:

> While examining the location [a cliff with one nest of Prairie Falcon and one nest of western redtail] we found that someone had shot a bird from each pair, oddly enough it being the male Red-tail and the female Falcon, their bodies lying on the ground close to their respective nests. The remaining parents had continued to 'carry on,' however, and the young that both nests contained seemed to be in excellent condition. When we appeared upon the scene and worked around close to the cliffs we started a very interesting disturbance between the two birds, both of which showed the greatest solicitude. Their previous unfortunate experiences with mankind had evidently taught them to keep well out of gunshot range of human beings, but the Falcon was apparently so angry that he had to give vent to his feelings on something, the nearest available object being the poor female Red-tail. Consequently we were treated to a most marvellous exhibition of what can be done by two trained experts in the art of flying, and the unusual and graceful movements of the Hawk were as thrilling to us as they were unexpected. The Falcon would mount high in air over her and then drop down upon her like a meteor until so close that it seemed inevitable he must tear her to pieces. Then, just as he seemed upon the point of striking her, the Hawk would turn gracefully back downward and thrust her great talons up at the approaching Falcon. Then there seemed no possible chance of avoiding a collision that would have meant almost certain death to them both, but always the Falcon would swerve in the very nick of time, missing by the merest fraction of an inch. This most interesting performance kept up until we left.

Mr. Bond (1936b) says: "At an eyrie in western Kern County a female was flushed from the eggs and was joined in the air by the male.

A pair of Barn Owls (*Tyto alba pratincola*) flew from the same cliff. The female Prairie Falcon broke the wing of the female owl, and the male falcon killed the male owl outright, each with a single stoop."

Although I have long known that this falcon likes to chase and hector large birds, I still wonder why it chooses the great blue heron so often. Is it simply because of the size of the heron and its very evident fear of the falcon? Ellsworth D. Lumley writes us: "These birds seem to take delight in annoying the herons, for I watched one of them as he repeatedly dived toward a heron that was standing on the rock cliff, coming to what appeared to be inches of the heron's head. The heron always ducked and lowered himself as the falcon sped by. The herons were also attacked when flying by the falcons, although I never saw one of them struck." Like Mr. Lumley, I have never seen a great blue heron actually struck by this tormentor, but the falcons I have seen seemed to take a positive delight in seeing how closely they could sweep and in how loudly they could make the herons shriek.

In spring falcons are keen, dashing, and wary, beautiful to see as they dart across the country. But in autumn they may be seen at times hunched up, like a clod, on some bare limb or pole. If startled then they may only fly negligently a few hundred feet and may even show entire indifference to a person's presence. Usually they catch their food by dashing, lightninglike swoops that are the very essence of grace and wildness. At other times they may be seen hopping on the ground or across the grass, like small fowls after grasshoppers. They may be seen over low plains and deserts, or they may be up over snow-clad mountains. Tyler (1923) says:

> A moody creature at all times, peevish and whimsical, the Prairie Falcon is a bird of extremes. One never knows just what to expect from this handsome falcon and the expected seldom happens. He may fairly dazzle us with a burst of speed as he comes in to his nest cliff from a long flight over the sage-covered ridges; but our admiration fades as we behold him stoop-shouldered and motionless, for an hour at a time, on some low mound in a pasture, a picture of listless dejection.
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> A pair of ravens in a nest not fifty feet from the falcons' own pot hole may be tolerated for days at a time with no act to indicate that the falcons are even aware of the presence of their neighbors. Then a sudden outburst of anger, totally unprovoked so far as the human eye can detect, may mark the beginning of merciless and unceasing persecution. * * *
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> Sometimes the canyons echo with her noisy cackling as the female falcon strikes again and again at the observer who approaches her nest cliff and yet, when, upon a return visit, we expect the same thrilling demonstration, she often flaps silently away with all the cramped awkwardness of a sparrow hawk just aroused from the duties of incubation.
>
> With a roar of wings the male sweeps along a canyon wall, dashes into a feeding flock of quail, snatches a victim and beats away like some giant swift; but when we hope to see this marvelous exhibition of flight repeated, we find him hopping around sparrow-like on the ground in some summer fallow field scrutinizing the bunches of stubble for a chance hidden meadowlark or Savannah sparrow.

A wounded falcon, or one who has changed her nesting site only to have the new location discovered, can give an exhibition of unmistakable anger which defies all attempt at description; but an overfed mid-October bird as it sits dreamily on a roadside fence post is usually too utterly lacking in spirit to attempt anything that requires more energy than a lazy flight to some more secluded perch.

Because so much of the time our only view of falcons and hawks is while they are on the wing, the flight of the prairie falcon is of particular interest. It is direct and swift, with short, powerful beats of the wings. Mr. Bent says that the prairie falcon "flies with rapid strokes of its pointed wings, the strokes being more downward than upward, with frequent spells of sailing." S. F. Rathbun writes that in eastern Washington the normal flight is strong and even with "a succession of rapid wing-strokes, then short glides"; and that "when even a strong wind is on its counter, the plane of its flight is not in the least affected. At one time a bird hovered for a space above the sage, then made a very wide sweep and returned to alight upon the surface of a freshly fallowed field. In many of its flight actions the prairie falcon resembles the sparrow hawk. Its hovering is identical and of common occurrence. But the prairie falcon's dashing and rapid flight is what gains a person's immediate notice and admiration." At another time Mr. Rathbun wrote: "What tricks this bird can pull in the air! How fast it flies! When one is close to it, you have a better appreciation of its flight. I never enjoyed anything more than watching the flying of these two birds. But at the speed they flew I would hate to have one hit me." Nor is Mr. Rathbun alone in being impressed by the swiftness of this flight. J. G. Cooper noted it as long ago as 1870, and ever since that date ornithologist after ornithologist has admired it. Its flight has often been compared to that of the swift. As a rule there is little circling except at great heights above the ground. In its descent upon prey, the speed of the bird is so great as to be "as swift as an arrow" and to earn for the bird the name of "bullet hawk." So rapid is the swoop and so powerful the blow that the prey must often be killed before it is at all aware of the danger. Over the foothills of the Rocky Mountains I noted that the height of hunting falcons was usually only 30 or 40 feet above ground; but when they did mount into the air, over the more level valleys, they ascended very rapidly and were soon lost to sight. Not only does the prairie falcon swoop, but the speed of its flight is great enough to catch even rather swift prey by direct pursuit. When it chooses to alight upon a high perch it flies low and when close enough suddenly closes its wings and shoots gracefully up to the desired height because of the speed already attained. Naturally such marvelous fliers give graceful, wonderful exhibitions near their nests.

So far as the literature shows, Mr. Taverner was uniquely favored when he found prairie falcons bathing. He (1919a) says: "They were usually seen bathing in the shallows of the river shore." And in a letter Mr. Taverner adds: "We saw the birds splashing in the water from afar in true bird-bathing style."

Voice.—The notes of the prairie falcon are somewhat similar to those of the American sparrow hawk but are louder, fiercer, and wilder. Bendire (1892) says: "Their alarm note was a rapidly repeated 'kéé, kéé, kéé,' and a sort of cackle." Peabody (1907) says there are two cries "that might be written down: a rattling, '*Kr-r-r-r*,' with rising intonation; and a peevish, whining '*kruk*.' This I find compared in my note book to a noise made occasionally by flickers, or to one call of the guinea hen." Decker and Bowles (1930) say: "The cry may be described as a shrill yelping 'kik-kik-kik-kik-kik,' repeated over and over again. It strongly suggests a combination of the cackle of a Cooper's Hawk (*Accipiter cooperi*) at its nest and the alarm notes of the Greater Yellow-legs (*Totanus melanoleucus*)." But the best general description that we know of is that given by Tyler (1923), who writes:

> The voice of the Prairie Falcon is, on the whole, rather disappointing. A series of rapidly-repeated screeching, whistling, or cackling notes of varying tone and pitch constitute the usual calls, and these are most often heard in the spring months near the nesting cliffs. Sometimes these notes are given with considerable spirit, but often there is recognizable a sort of indifferent tone. In many cases I have been unable to detect any difference between the voices of the male and female of a pair of falcons, but some females, which may be old birds, have harsh cackling voices, while a few males with which I have come in contact have rather pleasing high-pitched whistling calls. While inspecting nests I have often found that one of the pair of birds will remain silent while the other makes all the noise, but this is not always the case. In the majority of instances it has been the male that whistled while his mate kept silence. Occasionally, both birds of a pair will become enthused and the resultant din is most thrilling.

Enemies.—Such a bird as the prairie falcon is naturally let alone by most birds, and, because of its lonely life, contacts with others are rare. No doubt antagonisms between two or more pairs of these falcons are fierce and intense. Howard (1902) writes:

> When we were within a few hundred feet of the cliff we were greeted by a sudden screaming, and on looking up saw three prairie falcons in an aerial combat.
>
> Their flight was very swift and graceful; undoubtedly two of the birds were the pair nesting in the cliff and the other an intruder. One bird of the pair was following in close pursuit of the enemy while its mate would ascend high into the air and with folded wings drop like a falling stone and at the same time utter a shrill scream. Just at the second one would naturally expect to see the enemy dashed to pieces, a slight turn of the tail would carry him to one side and the would-be assassin would dart harmlessly by like a flash.

Most of the small birds keep out of the falcon's way as far as possible. Still, I once saw a prairie falcon pursued across a valley by a scolding Clark's nutcracker, although it soon escaped into the top of a dead fir. And Pierce (1915) says: "On January 9, 1915, I collected another female Prairie Falcon near Chino, California. My attention was drawn to this bird, which was sitting in a large branching willow, by the actions of some Red-winged Blackbirds (*Agelaius phoeniceus neutralis*) that were sitting about in the same tree with the falcon. Several of their number kept persistently flying at the falcon, who apparently cared little for their actions, as she sat quietly until I approached."

With other raptors the contacts observed have largely been fighting ones. Brooks (1909) says that "a male Peale Falcon incessantly badgered the female Prairie Falcon of a pair nesting near, with a series of splendid stoops." Of a nesting site known to have been used previously to 1901 by prairie falcons, Cohen (1903) writes: "In 1901, March 30, the site was tenanted by a pair of duck hawks * * *. It is probable that no pair of duck hawks, or even prairie falcons dwell within a few miles of each other's domain owing to mutual antagonism * * *. In 1902 we did not arrive at the prairie falcon nest until April 15, so as to allow the usurping duck hawks ample time to pay the rent, and found things vice-versa once more." Grinnell, Dixon, and Linsdale (1930) record that "a great horned owl was trapped at Eagle Lake on October 19, 1923. A Prairie Falcon that discovered the owl in the trap swooped and struck at the bird repeatedly."

One strange enemy with which the prairie falcons could ill contend was the open tar pits in California. The bones of the victims have been collected and reported upon by Dr. Loye Miller. He says there were great numbers of prairie falcons, duck hawks, and an extinct falcon caught at the McKittrick pool, but not so many at the Rancho La Brea now within the western limits of Los Angeles.

We so rarely get any items on the parasitic enemies of birds that the following is particularly welcome. Ellsworth D. Lumley writes of a prairie falcon taken in the act of killing a chicken: "I found its stomach contained a pocket gopher, but more interesting than this I found its entire viscera filled with long white roundworms. These were wound through the mesentery, intestines, cardiac muscles, even into the lungs and trachea. The insides of the bird looked almost as if they had been sewed together with white thread." These worms have since been identified as *Serratospiculum tendo* by Dr. John E. Guberelet, of the University of Washington, who further adds that these parasites are not uncommon in hawks in various parts of the world.

Winter.—According to Decker and Bowles (1930), these birds change their diet from rabbits to birds in winter. The stomachs of the birds mentioned in the previous paragraph all contained the remains of western meadowlarks. Cameron (1907) says the Montana prairie falcon is a "relentless persecutor of the Sharp-tailed Grouse. I have even seen the falcon watching on a pine for the grouse to emerge from the snow at its foot. On February 7, 1895, an adult Prairie Falcon (now in my possession) was shot by a neighbor, J. C. Braley, at Terry, under peculiar circumstances. His wife was cooking beetroot and threw out the refuse on the snow, when the falcon, passing overhead, stooped to the beetroot which it probably mistook for raw meat." That these falcons do thus pass the winters in this cold Montana climate was also noted by Bendire (1892): "I have met with them (during winter) at Fort Walla Walla, Washington, and also shot an adult male on February 19, 1885, at Fort Custer, Montana, while the weather was still intensely cold."

Although this is a bird of the wide open spaces, it was seen inside the city limits of Denver in December 1919, at least. There it was supposed to have preyed on juncos and English sparrows. Curious to say, Dr. Fisher found these falcons under nearly the opposite conditions in winter, in Death Valley, Calif. There is additional evidence that many falcons spend at least the winters over the desert ranges of southern California and Nevada.

Prairie falcons are resident in most of the California habitat, and their winter habits are not known to differ from those of other seasons.

DISTRIBUTION

Range.—Western United States and southern Canada east to southeastern Saskatchewan, the Dakotas, and Missouri and south to Mexico and Lower California. Accidental in Minnesota, Wisconsin, Illinois, and the Farallon Islands.

Breeding range.—The breeding range of the prairie falcon extends **north** to northern Washington (probably Lake Chelan); southeastern British Columbia (Osoyoos Lake and probably Deer Park); southern Alberta (Elbow River, Milk River, and Little Sandhill Creek); southern Saskatchewan (Eastend and probably Last Mountain); and North Dakota (Fort Lincoln). **East** to North Dakota (Fort Lincoln); southeastern South Dakota (Harrison); and northwestern Missouri (Maryville). **South** to northwestern Missouri (Maryville); northern Texas (Blanco Canyon); New Mexico (Mesa Pajarito, Montoya, Santa Rosa, Capitan Mountains, probably Big Hachita Mountains, and Animas Mountains); southern Arizona (Tombstone and Huachuca Mountains); and Baja California (San Luis Island and San Esteban). **West** to Baja California (San Esteban); California (San Pasqual, Colton, probably Mount Pinos, Sargents, Berkeley, East Park, and probably Shasta Valley); Oregon (Fort Klamath, Prineville, and The Dalles); and Washington (probably Walla Walla, Cheney, and probably Lake Chelan).

Winter range.—The winter range of this falcon extends north nearly to the limits of its breeding range. At this season it is found **north** to

Washington (Walla Walla); rarely to Okanagan Landing, British Columbia; Montana (Billings); rarely southeastern Wyoming (Cheyenne); and Nebraska (Alda and rarely Omaha). **East** to Nebraska (rarely Omaha and Red Cloud); Kansas (Hays); Texas (Corsicana); Nueva Leon (Monterrey); Hidalgo (Real del Monte); and Oaxaca (Tehuantepec). **South** to Oaxaca (Tehuantepec); and Baja California (Cape San Lucas). **West** to Lower California (Cape San Lucas, San Jose del Cabo, Mira Flores, and San Jose); California (Chino, San Fernando, Paicines, Petaluma, and Marysville); Oregon (rarely Corvallis); and Washington (Walla Walla).

Spring migration.—Early dates of spring arrival at points north of the winter range are: South Dakota—Harrison, February 7; Vermillion, April 4. North Dakota—Harrisburg, March 21. Saskatchewan, Osler, April 11. Alberta—Manton, March 28.

Fall migration.—Late dates of fall departure are: Alberta—Brooks, October 12. Saskatchewan—Eastend, October 18. North Dakota—Red River Valley, October 2; Foster County, October 8 (once, December 6, 1891). South Dakota (rarely winters)—Harrison, October 30; Yankton, November 9. Southward flights of this hawk have been noted in August in New Mexico.

Some idea of the movements and (for some birds) lack of extensive travels of these falcons may be found in a few recovery records of banded birds. Three juvenile birds banded on May 18, 1930, in the Lucerne Valley, Mojave Desert, Calif., were retaken as follows: The first on October 6, 1930, at Lancaster, Calif.; the second on October 28, 1930, near the point of banding; and the third on December 15, 1931, nine miles east of Calipatria, Calif. Another juvenile, banded on May 2, 1928, at Merrill, Oreg., was recaptured about August 5, 1928, at Irvine, Alberta; while still another banded at the same time and place was retaken at Arbuckle, Calif., on September 29, 1928.

Casual records.—Among several records (some sight) for Minnesota, the following may be mentioned: A specimen from Traverse County on September 11, 1894; a female taken near Madison on September 24, 1895; an immature male near Pipestone, on November 1, 1930; and a somewhat doubtful record of one purported to have been taken during the winter of 1890–91 at Benson, Swift County. There are several records for Iowa and a rather doubtful record without date or exact locality for Wisconsin (Kumlien and Hollister, 1903). In Illinois, one was taken at Rock Island sometime prior to 1872; one at Mount Carmel on September 27, 1871; and one at Bridgeport in July 1871. There also is a record of one on the Farallon Islands, Calif., on December 18, 1886.

Egg dates.—California: 134 records, March 1 to May 25; 67 records, April 6 to 15, indicating the height of the season.

Washington and Oregon: 16 records, March 25 to April 28; 8 records, April 5 to 14.

Alberta and Saskatchewan: 7 records, April 22 to June 14.

Montana and Wyoming: 14 records, April 25 to June 10; 7 records, May 4 to 19.

Texas and Mexico: 10 records, February 18 to May 25; 5 records, April 22 to May 10.

FALCO PEREGRINUS PEREGRINUS Tunstall

PEREGRINE FALCON

Contributed by Francis Charles Robert Jourdain

The European race of this species is included in the third and fourth editions of the A. O. U. Check-List on the ground that it is "casual in Greenland." Herluf Winge (1898) ascribes all Greenland birds, from both west and east coasts, to *Falco peregrinus* Tunstall var. *anatum* Bonaparte, i. e., the duck hawk. This was generally accepted until 1926, when O. Helms published a little work on the birds of Angmagsalik, based on the collections and notes of Johan Petersen. Here he states that the "nomadic Peregrine" has reached Angmagsalik and breeds there, but sparsely and only at intervals of years. He records nests found in 1909, 1912, and 1924 and states that Petersen had birds brought to him, shot from the nest on May 26, 1909, and a male, also shot from the nest on June 11, 1912. These two skins were sent to Denmark, and Helms reports that the 1909 bird proved to be "a mature but not very old bird which, with its unspotted breast, closely resembled the American form, whereas the one shot in 1911 [1912?] was more like the European form." As all writers are agreed that the West Greenland bird is the duck hawk, this record is the sole evidence for the inclusion of the European bird. It should be noted that this specimen was a breeding bird.

E. Lehn Schiøler in his great work, Danmarks Fugle, vol. 3, pp. 399–405, published posthumously in 1931, who had before him a series of 19 adult males and 16 adult females from Greenland, including specimens of both sexes from Angmagsalik, admits only the American form (*F. p. anatum*) to the Greenland list. There is scarcely any doubt that the two specimens described by Helms were included in Schiøler's survey, although there is a slight discrepancy in the date of the second bird, which is given by Helms as 1911 in one place and 1912 in another, while Schiøler records it as 1914; and, as he had also splendid series of the European bird for comparison, his evidence can be accepted without hesitation. The extreme improbability of two races breeding in the same locality, when the nearest breeding station of one of the two is over 1,000 miles distant, also provides strong corroboration, and the race should be deleted from the American list.

FALCO PEREGRINUS ANATUM Bonaparte

DUCK HAWK

PLATES 11–15

HABITS

This noble falcon is our representative of a world-wide species, of which some 16 races have been recognized in various parts of the world, including all the continents and most of the principal islands. The best known of these races is the European form, *F. p. peregrinus*, from which our bird differs in having a whiter throat and upper breast, with little or no dark marking; our bird also has a wider moustacial stripe and more black on the sides of the head. The European race is on our Check-List as "casual in Greenland", but the best authorities now refer all Greenland birds to *anatum* (see p. 42).

I do not like the name duck hawk, as it suggests a close relationship to the hen hawks and other ignoble hawks; neither do I like the old name great-footed hawk, used by Audubon and some of the early writers; this suggests clumsiness, a trait far removed from this graceful and agile falcon. I should prefer to call it the American peregrine falcon, but duck hawk seems to be the established name.

This large falcon is widely distributed in North America, breeding from beyond the tree limits in Arctic regions southward to some of the more southern States; it is very rare on the central plains and is nowhere abundant, though its range extends from the Atlantic to the Pacific. It is an eventful day when one can see and admire the dashing flight of this bold warrior.

Joseph A. Hagar, Massachusetts State ornithologist, has been very active for the past two years, 1935 and 1936, in protecting the duck hawk in this State. He has visited repeatedly all the known aeries in the State, some dozen or more, spent many full days in the field each season, making as many as a dozen or more trips in a season to a number of them, and made an intensive study of the habits of this interesting falcon. He has taken voluminous notes and accumulated many valuable data on the subject, all of which he has generously placed at my disposal. He contributes the following interesting account of the spring and courtship activities:

Courtship.—"In Massachusetts adult duck hawks reoccupy the breeding stations before the end of February, and since the first eggs are not laid before March 25 or April 1, there is a long and interesting courtship. So wonderful are the aerial evolutions of the peregrines during this season that I am inclined to think that no observer can fully appreciate their powers of flight who has not seen them at the nesting site on a windy March day; every movement, no matter how extended, is centered about the home cliff, so that its whole course may be traced, which is not usually the case at other seasons and places.

"There is some evidence that it is the male bird that is strongly attached to the cliff—that he returns there first and endeavors to attract a female, but if unsuccessful, remains there throughout the summer, while unmated females apparently roam about from place to place. Whether the duck hawk mates for life, and the female of the previous season returns directly to the cliff, if still alive (as has been generally assumed), I am not yet prepared to say, but I do recall very vividly a little drama that throws considerable light on the initial stages of courtship. This took place at Mount Sugarloaf on March 16 and involved a male peregrine that at that date, some three weeks after his return to the mountain, appeared to be still unmated. I had been watching him for more than an hour as he sat quietly on a dead pine above the cliff and during this whole period had heard no call or seen no such animation as is associated with the courting period. Suddenly, at about 9 o'clock, he launched out from his perch and began to sail back and forth along the face of the cliff, repeatedly giving the *wichew* or rusty-hinge note. A moment later I spotted a large female peregrine coming up the valley from the south, some 200 feet above the mountain. Arriving abreast of the cliff, she began to describe wide circles over the crest, flying very leisurely and seeming to watch the proceedings below her; the tercel redoubled his cries and flew from one shelf to another, alighting for a moment on each one and then swinging along to the next, with every appearance of the greatest excitement. The falcon, having presently completed three or four circles, now straightened her course toward the north, and picking up speed with every stroke of her wings soon disappeared in the haze along North Sugarloaf; the male continued his vain activity, wailing and *wichew*-ing for nearly a minute after she had passed from sight. He then made a short silent sally out over the valley and finally returned to sit hunched up and quiet on his dead tree for many minutes, before leaving on a hunting expedition behind the mountain. This episode introduces several of the elements of the courtship—the flight display, the shelf display, the coaxing *wichew* note—and it remains only to elaborate on their use and to mention the food-bringing routine.

"The male assumes an aggressive role throughout the first part of the period, seeming to arouse and lead on the female from step to step of the reproductive cycle. With both birds at a cliff, early in March, the first business of each morning is feeding. Shortly after daylight the falcons will be discovered perched on their favorite dead trees on the upper part of the cliff, watching closely for the passing of some smaller bird suitable for prey. If none appears near at hand the male will sally out at intervals and go far across the valley, returning perhaps at the end of 20 or 30 minutes with a blue jay hanging limp in his talons. He wails while still at a distance, and the female, wailing in return, flies to meet him and receives the bird in the usual way. Or perhaps his search has been in vain, and he suddenly plunges down from a great height, empty-footed, to resume the watch from his perching tree. Perchance a flicker now appears flying up the valley at a considerable height above the trees, but still below the level of the hawks; they both start out from their trees and, stroking steadily, converge on the unfortunate bird with a speed and deadly earnestness chilling to the onlooker. The female takes the lead. The flicker sees its peril too late, and in a trice the falcon snatches it dead in the air and, turning sharply about, heads back for the cliff while her mate convoys her from behind. She lights on her tree, holding the bird against the branch with one foot, and in another moment flicker feathers are drifting down-wind as she eagerly plucks her booty. Meanwhile the tercel sallies forth again over the valley and this time returns with his bird. There are many variations of this morning scene—the birds may go away hunting together, the male may make his kill near the cliff, or the female may miss her stoop, in which case the tercel often stoops at the same bird—but certain parts of the pattern are quite invariable. In general, the female stays closer to home; if they both chase the same bird, the female makes the first stoop; and she eats the first bird whether she kills it herself or the male brings it to her.

"Having fed, the hawks are likely to sit quietly for some little time, occasionally wailing to each other, preening their feathers, perhaps lazily stretching first one wing and then the other. At length the tercel starts off his perch and begins to soar and swoop about the cliff, describing a series of figure-eights in the air, sometimes in a horizontal, sometimes a vertical, plane. At times he lights on little shelves and *wichews*; again he returns to his tree and wails, or perhaps he soars higher and higher in the air, farther and farther out across the valley, until at last he shuts his wings to his sides and plunges down in a mile-long swoop that brings him back to the cliff. Sometimes the falcon accompanies him on these flights, but for the most part she is distinctly passive. The culmination of these flight displays depends much on the weather, but eventually the patient watcher will see an exhibition of flying that is literally breath-taking. I have seen it at many nest sites, but never to better advantage than one beautiful spring morning at Black Rock when a rising southerly gale was whipping along the flanks of Mount Everett. We were hidden in the woods below the south end of the cliff, and the peregrines were quite unconscious of our presence at the time; again and again the tercel started well to leeward and came along the cliff against the wind, diving, plunging, saw-toothing, rolling over and over, darting hither and yon like an autumn leaf until finally he would swoop up into the full current of air and be borne off on the gale to do it all over again. At length he tired of this, and, soaring in narrow circles without any movement of his wings other than a constant small adjustment of their planes, he rose to a position 500 or 600 feet above the mountain and north of the cliff. Nosing over suddenly, he flicked his wings rapidly 15 or 20 times and fell like a thunderbolt. Wings half closed now, he shot down past the north end of the cliff, described three successive vertical loop-the-loops across its face, turning completely upside down at the top of each loop, and roared out over our heads with the wind rushing through his wings like ripping canvas. Against the background of the cliff his terrific speed was much more apparent than it would have been in the open sky. The sheer excitement of watching such a performance was tremendous; we felt a strong impulse to stand and cheer.

"As March advances, the male peregrine tries more and more to entice the female to certain shelves he has picked out. Between hunting trips and exercising flights above the valley he spends long intervals on these shelves, scratching around in the debris, *wichew*-ing in his most persuasive tones, standing at their front edges breast out to the sun, wailing mournfully now and then, and even flying to the female's roost tree to *wichew* at her in soft conversational tones. At first she pays no attention, nor leaves her tree, but gradually her passivity gives way to mild interest; she flies to the shelf where he is working and lights there; they both walk back out of sight and for a moment there is an outburst of argumentative *wichew*-ing and creaking as she seems to disagree emphatically with all his plans. Either bird may come off first, leaving the other to scratch and dig around, but as a rule they do not both stay. At any time now the female may be seen to return to her tree alone; the male *wichews* excitedly at one or more shelves and then comes off the cliff, flies directly to her with no other preliminaries, and copulation takes place to the accompaniment of a low, conversational, chuckling noise, which is entirely distinct from the usual notes. Coition is more likely to occur near the middle of the day and is usually repeated within an hour or so; it is also repeated on succeeding days until at least two eggs are in the nest.

"The interest of the male in nesting shelves now begins to wane in inverse proportion to the female's increasing, though somewhat furtive, activity. While he is away hunting she may be seen going all over the cliff, squeezing into the most inadequate cracks and niches, scratching and scraping with bill and feet, turning round and round to get the feel of tentative nest hollows. At length she chooses the site, apparently with no reference to the male's previous selection, and in the course of a few days makes a smooth well-rounded scrape an inch or two deep. If disturbed at this time she is very likely to pick a new site at once and hurriedly prepare it, and I have several times had the experience of watching a falcon carefully form a nest hollow only to return after a short interval and discover the first eggs in quite a different spot on the cliff. The eggs are laid at intervals of every other day, with often two full days between the third and fourth."

Nesting.—I shall never forget how my youthful enthusiasm was fired by reading in my ornithological primer, Samuels's "Birds of New England", the thrilling account of the taking of the eggs of the great-footed hawk on Mount Tom by C. W. Bennett, on April 19, 1864, and how I longed to have a similar experience. But it was many years before I had the pleasure of visiting this historic old aerie. Duck hawks had been known to breed in the Holyoke Range, including Mount Tom, in central Massachusetts, and on Talcott Mountain in Connecticut since 1861, where they had probably nested for many previous years. Dr. J. A. Allen (1869) says that the eggs taken by Mr. Bennett "were the first eggs of the duck hawk known to naturalists to have been obtained in the United States, the previous most southern locality whence they had been taken being Labrador." He says further:

> Mr. C. W. Bennett, of Holyoke, their discoverer, has since carefully watched them, and his frequent laborious searches for their nest have been well rewarded. In 1866 he took a second set of eggs, three in number, from the eyrie previously occupied. In 1867 the male bird was killed late in April, and this apparently prevented their breeding there that year, as they probably otherwise would have done. At least no nest was that year discovered. In 1868 hawks of this species were seen about the mountains, and although they reared their young there, all effort to discover their nest was ineffectual. The present year (1869) they commenced to lay in the old nesting place, but as they were robbed when but one egg had been deposited, they deserted it and chose a site still more inaccessible. Here they were equally unfortunate, for during a visit to this mountain, in company with Mr. Bennett (April 28th), we had the great pleasure of discovering their second eyrie, and from which, with considerable difficulty, three freshly laid eggs were obtained. Not discouraged by this second misfortune, they nested again, this time depositing their eggs in the old eyrie from which all except the last set of eggs have been obtained. Again they were unfortunate, Mr. Bennett removing their second set of eggs, three in number, May 23d, at which time incubation had just commenced. The birds remained about the mountain all the summer, and from the anxiety they manifested in August it appears not improbable that they laid a third time, and at this late period had unfledged young.

Probably these falcons, or their successors, have nested on Mount Tom ever since then. When we visited this locality on April 14, 1928, we found the nest situated on a shelf of rock 55 feet from the base of a nearly perpendicular cliff, 120 feet high, above a long, sloping talus of broken rock. The photograph (pl. 11) taken by my companion, Robert L. Coffin, shows the general location very well but gives only a faint idea of the beauty of the landscape spread out before us, the alluvial plain of the Connecticut River with its panorama of fields, gardens, orchards, and woodlands, dotted with farm houses and intersected by the winding, silvery thread of the river. The ledge, on which the aerie was located, was about 14 feet long, 6 feet wide at its widest part, and only 20 inches wide at the nest. Some grass and moss were growing on it, a gray birch sapling grew near the center, and a few very small birch saplings fringed the narrow end in front of the nest. The four handsome eggs lay in a slight hollow, an inch and a half deep and about 12 inches wide, scraped in the accumulated soil and rubbish, and surrounded by flakes of rock, a few twigs, scattering bird bones, several pellets, and an aluminum band from the leg of a carrier pigeon. The nest is well illustrated in the photograph (pl. 11) taken by my other companion, Frank C. Willard, who climbed up to the nest from below, while I handled the ropes on the top of the cliff.

On that same trip, in the same general region, we visited four other nesting sites, at all of which the birds were in evidence and solicitous; at one place we failed to locate the nest, and at the others the nests were empty, evidently robbed. On Sugarloaf Mountain the empty scrape was on a small shelf, less than 10 feet from the top of the high cliff and easily accessible. The aerie on Mount Tekoa was also easily reached, as it was about halfway up on a low irregular cliff not over 50 feet high; the ledge was partly overgrown with grass, and the nest was merely a hollow lined with grass.

I had found a duck hawk's nest with eggs twice previously on Bear Mountain in this same range. This is a steeply sloping mountain of about 1,000 feet altitude, more or less wooded on the slopes and capped by an almost perpendicular cliff of trap rock about 100 feet high. The nest had been located the previous year by my companion, R. P. Stapleton, on a fairly accessible ledge on a steeply sloping part of the cliff; but this year, 1907, the falcons had chosen for their aerie a small ledge, about 6 feet long and 18 inches wide, on the perpendicular part of the cliff, about 70 feet down from the top and 30 feet up from the base, protected from above by overhanging rock and difficult to reach from the only accessible side, as the rock bulged out so far that there was no foothold within 10 feet of the aerie. On May 18, 1907, the nest contained three half incubated eggs, laid in a hollow in the soil about 3 feet from a small gray birch. The following year, on May 16, these falcons had three heavily incubated eggs in the same spot.

The duck hawk breeds at various places in the Appalachian Mountain Chain, at least as far south as Tennessee. Albert F. Ganier (1931) found a nest on a picturesque, lofty crag on the slope of Mount LeConte, in the Great Smoky Mountains, on April 7, 1929; the site, which had probably been in use for years, was quite similar to those described above, "a shelf about 12 feet long and 15 feet below the top, on the vertical side." On March 30, 1930, he found another nest, 125 miles farther west in the Cumberland Mountains; "this nest was unusual, in that the eggs were laid in an old nest of the red-tailed hawk, built in a recess in the cliff some 90 feet from the bottom and 20 feet from the top."

Mr. Ganier (1933) also located a pair of duck hawks at Reelfoot Lake, in the northwestern corner of Tennessee, that were probably breeding there; he says: "On April 24, in company with a group of fellow students of bird life, the author identified a pair in the big timber at the upper end of the lake. They were so bold and vociferous in their protests that it was evident an eyrie with young was located in the hollow top of one of the old cypress trees nearby."

The European peregrine has been recorded as nesting in trees and there are a few such records for this country. Robert Ridgway (1889) writes: "In the spring of 1878, the writer found several pairs nesting in sycamore trees in the neighborhood of Mt. Carmel [Illinois]. Three nests were found in the immediate vicinity of the town. All were placed in cavities in the top of very large sycamore trees, and were inaccessible. One of these trees was felled, however, and measurements with a tape-line showed the nest to have been eighty-nine feet from the ground, its location being a shallow cavity, caused by the breaking off of the main limb, the upper part of which projected over sufficiently to form a protection from the sun and rain."

Col. N. S. Goss (1878) found—

> in February, 1875, a pair nesting about three miles southeast of Neosho Falls, Kansas, in the timber on the banks of the Neosho River. The nest was in a large sycamore, about fifty feet from the ground, in a trough-like cavity formed by the breaking off of a hollow limb near the body of the tree. I watched the pair closely, with a view of securing both the birds and their eggs. March 27 I became satisfied that the birds were sitting, and I shot the female, but was unable to get near enough to shoot the male. The next morning I hired a young man to climb the tree, who found three fresh eggs, laid on the fine soft rotten wood in a hollow worked out of the same to fit the body. There was no other material or lining, except a few feathers and down mixed with the decayed wood.

Western nests are often in pot-holes or other cavities in sandstone cliffs or high cut-banks. Major Bendire (1892) mentions such a nest, above the falls of the Missouri, that "was situated in a small hollow in a perpendicular wall of rock, some 15 or 20 feet above the base of the wall, and consisted of a few coarse twigs and bits of grass, forming a ridge on the outer side barely sufficient to prevent the eggs from rolling out." He also writes of a set of eggs taken by Denis Gale from an old eagle's nest on a rocky cliff on the Cache la Poudre Creek: "The site was in a rocky ledge about 80 feet high and about 50 feet from the foot of the cliff."

Edwin Beaupré (1922) found, in Ontario, a set of this falcon's eggs in a very unusual location: "They were laid among ferns close to some silver birch saplings on the open ground on the top of a cliff."

The islands off the coasts of California and Lower California offer ideal nesting sites for duck hawks, where they are free from predatory animals and where they find abundant food among the sea birds. Here their nests are often easily accessible to the collector, in some natural cavity or on some small shelf on a low cliff sometimes only 10 or 20 feet high.

Along the coasts of Labrador and Ungava the duck hawks nest on the islands or on cliffs on the mainland, usually near breeding colonies of gulls, eiders, or other sea birds. A pair had a nest on an island we visited near Nain, in the midst of a large colony of glaucous gulls and black guillemots. Lucien M. Turner says, in his notes from Fort Chimo, that there is scarcely an island near the sea-bird colonies that does not have one or more pairs of these falcons nesting on or near it.

Eggs.—The duck hawk lays ordinarily three or four eggs, occasionally five and very rarely six or even seven. In shape they vary from short-ovate or ovate to oval, or even elliptical-oval. The shell is smooth or finely granulated. The eggs are richly and handsomely colored; the ground color varies from creamy white to pale pink, but it is almost always nearly, or wholly, concealed by small blotches, spots, or fine dots of brilliant rich browns or reds, which are sometimes concentrated at one end. The colors most often seen are "Morocco red", "mahogany red", "brick red", "Kaiser brown", "hazel", "russet", or "tawny." Some light-colored eggs are "pale salmon color", finely speckled with "Congo pink", overlaid with a few scattering blotches of "cinnamon-rufous"; rarely one has faint underlying blotches of "pallid purple-drab." Often there is a solid wash of color at one end, or over the whole egg, with darker markings over it. The measurements of 61 eggs, in the United States National Museum, average 52 by 41 millimeters; the eggs showing the four extremes measure **57** by 43, 56.5 by **43.5**, and **48.5** by **38.5** millimeters.

Young.—The period of incubation has been said to be 28 days, but Mr. Hagar has definitely determined that it varies from 33 to 35 days. He says, in his notes: "The two sexes change places rather frequently from the time the first egg is laid until incubation begins, if the weather is cold or stormy; once incubation has started, the female sits very closely for the first two weeks or so, leaving the nest only long enough to receive birds brought in by the male. She is most likely to leave the nest late in the afternoon. The last half of the incubation period the male performs rather more of the incubation, usually taking short turns in mid morning and late afternoon, while the female goes hunting."

Only one brood is raised in a season, but, if the eggs are taken, the bird will lay a second, or even a third, set after about three weeks. Dr. Charles R. Keyes (1906) reports that a pair in Iowa laid two sets of six eggs each in one season.

Allen and Knight (1913) made a series of observations on a brood of young duck hawks near Cayuga Lake, N. Y. On May 11 the young were apparently about three days old.

> During the four hours that the nest was observed, the female brooded, except for two short intervals, when she left for the purpose of securing food. Each time a Rough-winged Swallow was brought in from a colony that had established itself in the gorge below. The young were still weak, and were fed with great care; quite differently from the mad orgies that took place later on, as they grew older. Between ten and fifteen minutes elapsed before either Swallow was consumed. Small bits were torn from it by the parent, and the young permitted to pick them off from the side of her bill. On May 19 the young were still in the down, though much larger. At this time, during the four hours of observation, two more Swallows were brought in; the Hawks seeming to fancy these birds, and pursuing them with evident satisfaction. * * *
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> The nest was not visited again until June 9, when the young seemed nearly ready to leave. Standing at the very edge of the ledge, they flapped their wings in exercise, as though they would like to sail across the gorge to meet their parents, and yet dared not. Their vision had become exceedingly acute, and every passing bird was watched with the keenest interest. They always saw the approaching parents long before the human eye could perceive them, and awaited them with the most intense excitement. They danced about the ledge and uttered the wild screams of their race. It seemed as though at any moment one of them might tumble from the precarious position. To add to the excitement, the parent bird never came directly to the nest, but passed by as if to tantalize her offspring. When she did come to the ledge, a wild fight ensued among the young for the possession of the game, and for a few minutes the proprietorship was undecided. Usually, however, the first one to get a hold managed to draw the prey beneath it, completely covering it and allowing the others no chance whatsoever. On this day, two pigeons were brought in, one by the female and one by the male. * * *
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> On June 21, but one young remained on the ledge. The others were flying about the gorge, but toward the latter part of the afternoon returned to the nesting ledge, evidently to roost. The first young to leave was now flying about with the ease of the adults, and could be distinguished from his parents only with difficulty. He, likewise, took great interest in the Rough-winged Swallows and frequently pursued them, striking, like his parents, from the side. The previous year the young were watched taking food from the talons of the parents in mid-air. As the adult bird glided up the gorge bearing food, the young flew out to meet it, coming from below and to the side, and struck the prey from its claws even as they were now striking at the live Swallows.
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> The young bird that remained on the ledge, though frequently exercising its wings, seemed to be fearful of trusting itself to the air, even when clods were tossed down, it lacked the stamina to go. Finally, however, as it perched on the brink and a stone struck too close for comfort, it jumped forth and set its wings. We were uncertain as to whether it could control its unaccustomed wings after leaving the supporting ledge, but to our surprise, when once started, it lost all timidity. Instead of sailing to the creek below, as we thought it might, it circled about the gorge, and, espying the trees in which it had so frequently

watched its parents, set its wings in that direction. There it landed safely, sixty feet above the ground, on a large branch close to the trunk, and was welcomed by its parents.

Joseph Dixon (1908) took three small downy young duck hawks from a nest in Alaska on June 16, when the largest one was just getting its eyes open.

He raised them in captivity and weighed them at intervals. On June 19, the smallest one weighed 5½ ounces and the largest 7 ounces. In five days they almost doubled in weight, to 9 and 12 ounces. They weighed 12 and 20 ounces on June 30 and 20 and 25 ounces on July 6. During the next two weeks their plumage began to develop until, on July 21, the largest was "a beautiful falcon with clean bright plumage and a general clear-cut neat appearance"; they weighed 25 and 26 ounces. On July 23, when about six weeks old, the large one was able to fly. "They were not particular as to their food as long as it was fresh meat, except that they preferred bird bodies to mice."

Dr. Elon H. Eaton (1910) says that sometimes the young "fall from the nesting-shelf and perish on the rocks below." He and his companions had watched an "eyry for 24 hours from a concealed station to observe the visits of the parent falcons. Food was brought only once in this time, and the young birds became unusually restless. Finally the male fell over the mountain side and was killed on the talus slope. I believe that the old birds in this case were trying to lure the young from the nest by bringing insufficient food to the ledge. As the young begin to fly the parent birds fly by with prey in their talons, and the young rise to snatch it from them in mid-air as they pass. Thus the weaklings are sometimes left to perish, or in their struggles to obtain the prize meet their destruction. The falcon's eyry must needs be a strenuous school to train the fiercest of all raptores for his murderous career."

From three nests, in which the date of hatching was definitely known by Mr. Hagar, the first young bird flew from the nest on the 33d, 35th, and 33d days, respectively.

Plumages.—When first hatched, the young duck hawk is rather sparsely covered with short, creamy-white down; when about 10 or 14 days old, this is replaced or concealed by longer, thicker, coarse down, pale grayish white above and creamy white below. When about three weeks old, the juvenal plumage begins to appear, and this is completed during the next two or three weeks; the flight stage is reached at an age of about five weeks. The plumage appears first on the back, scapulars, and head; the wings and tail are sprouting at about the same time. The pectoral tracts are then feathered, and the last of the down is seen on the back, showing through the plumage, on the center of the breast, and finally on the thighs.

In fresh juvenal plumage the crown is mainly "cinnamon-buff" to "cinnamon", lightly streaked with blackish; the lores, auriculars, and a broad rictal band are brownish black; the upper parts are "bone brown", broadly edged or tipped, especially on the lesser wing coverts, with "orange-cinnamon"; the under parts are from "Mikado brown" to "light pinkish cinnamon", fading later to "cream-buff", broadly streaked, except on the throat, with "bone brown" or "fuscous"; the dark brown tail is banded with broken bars of "cinnamon" and broadly tipped with "light pinkish cinnamon", fading later to pale buff.

The juvenal plumage is worn for a year or more, with only slight changes by wear and fading; the buffy edgings on the upper parts and the buff tips on the tail fade and wear away; and the under parts fade out to nearly white. The molt into the adult plumage is complete but varies greatly as to time in different individuals and is generally much prolonged; it sometimes begins in spring, when the bird is about a year old, but oftener it occurs during the following summer and fall.

The adult plumage is characterized by the gray upper parts, darkest on the head, where it is nearly black, and lighter gray, banded with darker, on the mantle; the under parts are white, often more or less washed with "pinkish buff" on the belly, sparingly spotted or streaked on the breast and belly and barred on the flanks with black. Adults have one annual complete molt, which is irregular and prolonged, as in the young bird. Signs of molting may be found during almost any month.

There is a tendency toward melanism even in eastern individuals. This is so well marked in some immature birds that they are almost as dark as young *pealei*. Baird, Brewer, and Ridgway (1905) describe one, taken near Chicago, Illinois, that is "above continuously pure black", and "beneath ochraceous-white; the neck, breast, and abdomen thickly marked with broad longtitudinal stripes of clear black." Of an adult, taken in Connecticut, they say: "The upper surface is plumbeous-black, becoming deep black anteriorly, the head without a single light feather in the black portions; the plumbeous bars are distinct only on the rump, upper tail-coverts, and tail, and are just perceptible on the secondaries. The lower parts are of a very deep reddish-ochraceous, deepest on the breast and abdomen, where it approaches a cinnamon tint—the markings, however, as in other examples."

Food.—The duck hawk is primarily a bird killer; nearly all its food consists of birds, ranging in size from mallard ducks down to warblers and nuthatches. The following long list includes many, though probably not all, of the birds that have been recorded in its food: Domestic pigeons and other poultry, grebes, auklets, murrelets, small gulls, terns, petrels, wild ducks from the size of mallards down to teals, small shearwaters, small herons, coots, gallinules, rails, woodcock, snipe, sandpipers, plovers, quail, grouse, ptarmigans, pheasants, sparrow hawks, cuckoos, kingfishers, mourning doves, flickers and other woodpeckers, marsh hawks, whippoorwills, nighthawks, chimney swifts, kingbirds, jays, crows, phoebes, starlings, bobolinks, blackbirds, orioles, grackles, meadowlarks, crossbills, goldfinches, grosbeaks, juncos and other sparrows, purple martins, swallows, tanagers, thrashers, catbirds, warblers, nuthatches, robins, thrushes, and bluebirds. Probably the very largest and the very smallest birds on this list are less often taken than those of intermediate size; pigeons, flickers, jays, meadowlarks, and other birds of similar size probably constitute the bulk of the food in inland localities; on the seacoast and islands, these hawks live almost exclusively on the smaller sea birds.

Dr. Paul L. Errington (1933) writes:

> It is plain that domestic pigeon is the Prairie du Sac peregrine's main staple. Bluejays, flickers, and icterids figure prominently. Next in order might be considered mourning doves, nighthawks, killdeers, and young domestic chickens. I have record of but the one duck (green-winged teal) from the feeding places, although Wisconsin, of course, is not much of a waterfowl state. Mammals do not seem to be brought in at all.
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> Various authors cite definite instances of ruffed grouse preyed upon by peregrines, but, while my nests were in excellent ruffed grouse country, I have not found a single trace in bone and feather debris from the Wisconsin falcons. Indeed drumming logs were located within 50 to 150 yards of two of the peregrine nest sites, and I cannot recall a visit at which grouse were not to be flushed. The impunity with which these grouse habitually frequented the vicinity of the peregrine haunts I ascribe to the entirely different habitats and adaptations of the two birds; the falcon's long pointed wings are ill-designed to whip into the brush in pursuit of a short-winged compact flyer like the ruffed grouse.
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> * * * Pigeons are spoken of as a nuisance by most of the farmers with whom I am acquainted; the rest of the prey is drawn largely from species that plainly thrive in spite of—or perhaps because of—the predator pressure they have always borne. And the Mourning Doves, swifts, nighthawks, martins and teal one might be pardoned for reckoning legitimate game for an aerial hunter equipped only with natural weapons, however superb.

Mammals form an insignificant part of the duck hawk's food. Remains of hares, rabbits, woodchucks, squirrels, and field mice have been found near their nests, as well as pellets made up of fur and bones of mammals. Even beetles and dragonflies have been found in their stomachs. Audubon (1840) says that they sometimes feed on dead fish; he found the eyes and scales of fishes in their stomachs.

The duck hawk is a clean feeder and a good sportsman. It wants live game and prefers to capture it on the wing. It is the swiftest of our birds of prey and can easily overtake our fastest flying birds. If the bird is not too heavy for it to carry, it dashes along beside or under it, often turning upside down, seizes the bird in its talons, and flies away with it. Larger birds it strikes with such terrific force as to kill its victim instantly, or send it tumbling to the ground, whither it descends to pluck and devour it. I believe that it always plucks its bird, at least partially, before eating it.

Allen and Knight (1913) say that "the Falcons never struck from above, but waited until opposite the victim, when, with a quick semi-inversion of the body, they fiercely struck the Swallow from the side. At one time the Hawk was observed to strike from nearly below the victim, so that an almost complete inversion was necessary." Dr. Charles W. Townsend (1930) saw a female duck hawk strike in flight, kill and carry off for 300 or 400 yards a lesser scaup duck. He also writes, explaining another method of capture: "I was watching a flock of Pectoral Sandpipers in the marsh when a Duck Hawk suddenly appeared and dashed into the startled flock which had jumped and were flying in all directions. The hawk turned, flew back and picked up a bird that it had struck down, and, without alighting, carried it off in its talons. The act of striking was executed with such speed that, although it took place within thirty yards of me, I failed to see it and did not realize what had happened until the falcon checked its impetuous career by banking and returned and picked up its victim."

Theed Pearse writes to me that he was watching wildfowl at sea near Courtenay, Vancouver Island, "when a bird came out from the shore flying at a great pace, not far above the surface of the water, skimming it; the glasses showed the bird to be a male duck hawk. I never saw a bird fly faster, and I lost sight of the bird for an instant, and the next thing I saw with the glasses was the hawk over the water, where one horned grebe was getting away as fast as possible and another was floating dead, belly up. The live bird did not interest the hawk, which swung around and swooped down, trying to pick up its quarry; it did this half a dozen times; each time it swept around to come at the dead bird up-wind; once it managed to lift the body well out of the water but could not retain it. Unfortunately, I did not see the actual strike by the hawk, but I think the hawk swept along so close to the surface and at such a pace that it struck and killed the grebe before the latter had time to dive, which it would have done had it seen the hawk; it seemed certain therefore that the kill was made on the surface of the water."

Duck hawks are especially fond of pigeons, living largely on them in some of our large cities in winter. Audubon (1840) says: "For several days I watched one of them that had taken a particular fancy to some tame pigeons, to secure which it went so far as to enter their house at one of the holes, seize a bird, and issue by another hole in an instant, causing such terror among the rest as to render me fearful that they would abandon the place."

Dr. C. Hart Merriam (1877), referring to a duck hawk shot on an island where terns were breeding, says: "During her brief visit she had made sad havoc among the Terns, and her crop was greatly distended with their remains, which had been swallowed in incredibly large pieces—whole legs, and the long bones of the wings were found entire and unbroken! Indeed she was perfectly gorged, and contained the remains of at least two adult Terns, besides a mass of newly hatched young!"

Dr. Alexander Wetmore (1933) thus describes the hunting tactics of the duck hawk on the Bear River marshes, Utah:

> The birds at rest perched in low willows, or on logs or bits of drift, where they had clear view of the teeming bird life about them. When hungry, they dashed across the open flats at high speed, striking ruthlessly at any birds that appeared, from small sandpipers to large ducks.
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> Their appearance in the air was always the signal for chattering cries of alarm from blackbirds and avocets that put all their bird neighbors on the watch. These warnings had little effect, however, as the duck hawk, killing practically at will, was truly despot of this realm.
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> I have seen this falcon dash through closely massed flocks of flying sandpipers, striking out two or three with as many thrusts of its claws, allowing each bird to drop and then wheeling swiftly to seize the falling prey in mid-air before it reached the ground. Again, I have seen one in a stoop, swift almost as light, knock a redhead duck to the ground, where it landed with a broken wing and other injuries.

Col. Andrew J. Grayson (1872) writes: "On a passage from Mazatlan to San Francisco, in 1858, on the bark Carlota, one of these falcons came to us, more than a hundred miles off the coast of Lower California, and took up his quarters upon the main-yard, or masthead; it remained with us two days, during this time it captured at least a dozen dusky petrels. It was a fine sight to see him dart headlong upon these unsuspecting wanderers of the deep, seldom missing his aim; he would then return to his usual resting place and partly devour his prize. At other times he would let them drop in the sea, after they were dead, seemingly in wanton sport."

Mr. Hagar kept a record of the bird remains that he found at the various aeries visited by him between March 28 and June 29, 1936; there were 22 domestic pigeons, 21 blue jays, 13 flickers, 7 robins, 6 meadowlarks, 3 bluebirds, 2 each of red-winged blackbirds, scarlet tanagers, and starlings, and 1 each of nighthawk, Baltimore oriole, and bronzed grackle.

He gives, in his notes, the following graphic description of the capture of a crow: "At 8.12 there appeared over the top of the mountain, and certainly almost as high again in the air, a strange whirling apparition that I was quite at loss to identify for the moment, whether bird, autogyro, or space ship from Mars—a shifting tangle of flapping wings, tails, necks, and whatnot. At first the progress of this flying apparatus was far from steady, and twice it paused in the air for an appreciable moment, but on the whole it approached over the mountain, and I began to suspect that part of it was the duck hawk. Suddenly there was another short tussle, lasting hardly longer than the twinkling of an eye; and from it emerged two recognizable shapes, a black and very dead crow underneath and to the rear, its head and wings hanging limply, and a very lively duck hawk ahead and on top. With no more effort than he would display to carry a sparrow, with speed diminished not a whit, the falcon winged out over the valley at a level height, banked sharply down wind until he faced the cliff, half-shut his wings to his body, and came down like a thunderbolt—one long, smooth, magnificent swoop that carried him well below his intended perch, then up again with unbelievable speed until he checked himself against the very face of the cliff, tossed his prize on a feeding shelf, and in the same instant lit beside it. For several minutes he stood at the edge, surveying the world with obvious triumph, then turned, took an awkward step or two, and went to work plucking feathers. Almost immediately he stepped up on the crow, and I could see him tearing off great bites from between his feet—now his head was lowered to take a grip, now he was standing straight up with neck extended, pulling the warm, red flesh with savage gusto—bobbing up and down, feathers flying. For 26 minutes he tore and gulped before finally leaving the shelf."

He describes the capturing of a pigeon as follows: "The pigeon had been flying level and at top speed; the falcon had been descending slightly, with continuous, strong, rapid wing-beats, and was moving at least twice as fast as the pigeon, so that the gap between them closed with inexorable speed; in the instant before the strike, the falcon had arrived at a point perhaps 12 feet behind the pigeon and a foot below it, when she suddenly changed direction, extended her talons, shot up across the pigeon's back, and, at the moment of passing, grappled her prey, apparently by the body just behind the wings, so that the two birds swept on as one, without the least perceptible pause. One instant the pigeon was flying desperately; the very next, it hung a limp bundle, with drooping wings and neck, in the talons of its terrible pursuer."

Ordinarily, when bringing food to the female, the male flies up to the cliff, carrying the bird in his talons, she flies out to meet him, he drops the bird, and she catches it in midair in her talons. Mr. Hagar describes two different methods of transferring the prey, as follows: "The male brought a small bird, not larger than sparrow size. As he flew past the cliff, he dexterously transferred it from his feet to his bill—the female came off the nest, flew under the male, giving the feeding call—he dropped the bird and she caught it in her bill before it had fallen three feet—she transferred it to her talons and lit on the dead tree to eat it."

On another occasion "the male came in from the east with a small bird, circled over the talus slope several times, and finally swooped in almost over the nest shelf, but 10 feet above it, without making a sound. The female came off in a moment, circled up under the male, giving the feeding call, and the bird was transferred from talons to talons."

Behavior.—The flight of the duck hawk is a marvelous exhibition of grace, agility, and speed. Few of its intended victims can escape. It seems to have speed in reserve, for a quick dash over, under, or to one side of its victim before delivering the death blow. Its long, pointed wings whip the air with quick, powerful strokes, giving it the momentum for the final dash on half-closed wings, as it swoops down on its prey with the sound of rushing wind.

About its aerie it flies swiftly, with from two to four or five quick strokes, followed by a longer period of sailing. I have read that it seldom soars, but I have often seen it do so; I have seen it sail, or soar, for a long distance on horizontal wings and spread tail, with little or no wing movement, rising, falling, or turning at will. Sometimes, when coming down from a great height, it makes a swift "nose dive" at terrific speed, with wings flexed and primaries pointing straight backward. It is a graceful master of the air at all times.

These falcons often indulge in playful flight for exercise or sport. Delos E. Culver (1919), writing of two that were playing about the tower of the Philadelphia City Hall, says: "When first observed they were engaged in aerial evolutions apparently purely for the joy of flying, now rapidly, now slowly, now chasing one another and then a rapid swoop to one of the lower ledges, the leading bird alighting and the other wheeling about the tower or out into mid-air. These evolutions were continued until dusk. * * * Often they were seen to fly directly toward one another with a very rapid flapping of the wings but in a labored manner so that they made very slow progress, and then when almost breast to breast they would turn suddenly and dive down vertically."

Dr. Wetmore (1933) writes:

> When not hungry, the duck hawk, feeling its superior strength, frequently indulges in harmless play at the expense of its bird neighbors.
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> Often I have seen them flying along the river channels, driving ahead of them a motley flock of blackbirds, herons, avocets, and other birds, herding them in disorder like sheep, but without offering to harm them. Again, as night herons flew ahead of my launch, a duck hawk would dart at them repeatedly, forcing them down lower and lower, until finally, with protesting squawks, they struck the water. They were not allowed to rise, but had to swim into the shelter of the willows to escape.
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> One pleasant afternoon in fall I heard a great roaring of wings overhead and looked up to see a cormorant that a few minutes before had been soaring peace-

fully high in air, dashing down with set wings toward the river, with a duck hawk a few feet behind. Just above the water the hawk suddenly accelerated, tapped the cormorant lightly on the back, then circled easily away, while the frightened quarry took refuge unharmed in the water. Frequently falcons at play dashed at top speed through milling flocks of flying sandpipers, scattering them like leaves in the wind, but not striking any of them.

Dr. Winsor M. Tyler tells me that he saw a duck hawk swoop down several times at some feeding hens; the hawk never came nearer than 4 or 5 feet and apparently was not attempting to strike them; the hens did not seem to be much alarmed, except when the hawk was just above them.

Alexander Sprunt, Jr., has sent me some interesting notes on some flight performances of a group of seven of these falcons, as observed by him and his companions on Grandfather Mountain, N. C., about the first of August 1930, from which I quote as follows: "Hardly had we seen the pair when three more appeared above the first two, circling rapidly. To the five already in the air came another and another, until the whole seven were wheeling and swooping about at close range. Then began a series of aerial evolutions that were worth far more than the exertion we had expended in reaching our lofty observation post. Pair after pair of the falcons would come together, whirl apart, and dart away at high speed, one climbing swiftly above the other in the heights. The uppermost bird would then swoop with incredible velocity at the other, and the two seemed to be in close contact for many feet at the termination of the plunge. That the birds were indulging in a sort of play was plainly evident. The wonderful plunges, the apparent contacts, and ultimate separations were entirely devoid of animosity, the falcons seeming to enjoy the performance as thoroughly as their observers."

William Brewster (1925), referring to the great speed and momentum of the duck hawk's flight, remarks: "Although this enables him to overtake the fastest-moving birds of other kinds with no less ease than certainty, it often foils his attempts to seize those given to sudden turns or erratic twistings, because he cannot with equal abruptness check or deflect his own headlong career, but must keep straight on for several yards, at least, before doing so, and hence constantly overshoots the mark. His supposed preference for water-fowl, as prey, and reputed prowess in dealing with them, may therefore be due largely to the fact that they are no more capable than he of abruptly devious flight."

As to the highest speed that this falcon is able to attain, we have very little accurate data. Its utmost speed has been estimated as ranging between 150 and 200 miles an hour; it may attain, or even exceed, such speed in its swift plunges, but no such speed could be maintained for any great distance. D. D. McLean (1930) timed with a stop-watch a hunting duck hawk and estimated its speed as between 165 and 180 miles an hour. The following observation, recorded by Ralph Lawson (1930), was made by an expert aviator in whom he had great confidence:

> He was flying a small pursuit plane, which had a normal speed of about 125 miles per hour and, while cruising about at a considerable altitude, he saw a bunch of ducks flying far below and ahead of him. Thinking to gain some experience in diving at a moving object, he turned the nose of his plane down and opened the throttle of his engine, thereby gaining speed rapidly. While he was still some distance from the ducks he glanced at the wingtip of his plane to see how much vibration his swoop was causing and as he did so, a hawk shot by him "as though the plane was standing still," and struck one of the ducks which fell towards the ground apparently lifeless. At the time the hawk passed the plane the latter was travelling at a speed of nearly 175 miles per hour and my friend thinks that the hawk was stooping two feet to his one but of course that is only an estimate as under the conditions no accurate computation was possible. We do know however that this particular hawk was moving at a rate of speed much greater than 175 miles per hour and perhaps not far from double that rate.

Mr. Forbush (1927) cites several instances where a duck hawk has attacked and killed larger birds. A red-shouldered hawk was struck and its skull "split wide open"; another was struck and seen to fall. "Audubon tells of a Snowy Owl which snatched a young duck hawk from its rocky perch, but was followed by the avenging parent, which quickly struck the larger bird dead."

Mr. Forbush also tells of a duck hawk that struck down a large merganser; when the dead merganser was picked up, it was "found that most of its side had been torn out by the force of the blow or the clutch of those powerful claws." He says further: "Swifts are believed to be the swiftest of all birds, and it has been generally asserted that the Duck Hawk is unable to overtake them. I have never found the feathers of a swift near a Duck Hawk's aery, but a farmer in the Connecticut Valley states that he saw this falcon capture a Chimney Swift. Many swifts, he says, were coursing above the fields, when the falcon made several dashes at them, but missed. At last as one turned to evade the rush, the hawk swung over on its back, and reaching up one foot as it shot by, caught the swift in its powerful grasp."

Although the duck hawk has been known to kill marsh hawks and sparrow hawks, both of these species have attacked and driven away this powerful falcon. I have seen a colony of common terns drive a duck hawk away from their nesting grounds by attacking him en masse. I once saw one of these falcons perched on a spruce tree, with a flock of Brewer's blackbirds sitting contentedly in the same tree; neither species seemed to be at all concerned about the other. Once a phoebe sat on its nest on a cliff near a falcon's nest that I was examining; I doubt if it was ever disturbed and it probably raised its brood safely. C. L. Broley has sent me the following note: "A duck hawk was flying high over a field when a small bird quickly mounted up and attacked it as a kingbird does a crow, swooping down in fierce plunges until the duck hawk turned and fled the way it had come, giving us an excellent view of the pugnacious little battler that had so completely turned the tables and put the deadly raptor to flight. It was a sharp-shinned hawk, a slight little fellow scarcely larger than a sparrow hawk! The enraged duck hawk was completely outmaneuvered by the little sharpshin, which mounted above it with the greatest ease time after time and dashed down on its back, apparently delivering blows that were at least irritating, as the duck hawk repeatedly tried to strike sideways at its spunky tormentor."

Very rarely have duck hawks been known to attack human beings that were disturbing their nests, but G. Bartlett Hendricks (1935) tells of an especially savage female that attacked four different people several times. All these people, while attempting to photograph the young hawks in the nest, were struck repeatedly and severely scratched by the sharp talons of the hawk. "A small boy, who was standing on the summit some distance from the nest, was hit from behind and knocked on his face." The hawk followed one of the men "a hundred yards or more from the nest and dove at him repeatedly."

Mr. Hagar had a somewhat similar experience with this same bird, at Monument Mountain, of which he says: "The female was even noisier and more demonstrative than on the day I found this nest, and by the time I was down on a level with the chicks was coming within a foot or two of my head at each plunge.

"This was interesting, so, by way of trying her out, I leaned down and picked up a youngster. Once he was in my hand, my attention was all on him and I forgot the matter for a moment—a short moment; she struck me a stunning blow on the top of the head. I was well wedged between the cliff and a small tree that grows just south of the nest, so that she could not have dislodged me, but my head stung for a minute. I kept my eye on her, as I replaced the chick and withdrew a few feet up the slope, and several times she passed inside of the little tree."

He says later, of the same bird: "This bird has struck everyone who has been to the nest since my last visit; ten days ago she attacked Ben Leavitt, apparently with both bill and feet, for she took a jagged bite out of his shoulder, tore the sleeve out of his shirt, and left three long scratches down his upper arm; and early in the week she struck Warden Giddings on the knee, as he stood beside the nest."

Voice.—When I visited the Bear Mountain aerie with R. P. Stapleton, he called a falcon from the cliff by giving a shrill, nasal, squealing call, *nyeh, nyeh, nyeh*, rapidly uttered in a high key, which he said was an imitation of its note. We also heard a note from the male that sounded like *nyee-ee-ee-ee-ee*, a long-drawn-out, shrill scream, somewhat suggesting the cry of the broad-winged hawk. While both birds were flying about the cliff, we heard a variety of shrill, whining, nasal notes, suggested by the syllables *wauk-wauk*, or *yaak-yaak-yaak*, or *quack-quaack-queck-quec-quec-quec-quec*, the first two or three notes in the last series being somewhat drawn out, with a nasal twang, and the last four or five much more rapidly given and shriller. The note is said to be like that of the sparrow hawk, but louder and more intense, or like that of the kestrel, but stronger and in a deeper key. It also has a hissing menace, like that of the owls; and the notes of the female are said to be hoarser than those of the male.

Mr. Hagar has contributed the following descriptions:

"An observer who knew the duck hawk only on migration would certainly call it a very silent bird, but during the breeding season it is an exceedingly noisy one. The notes are varied and expressive, so that it is frequently possible to know what goes on about the nesting cliff when the falcons are out of sight, yet it will be found that there are only three principal calls, of which all the rest are but variations.

"The first of these, which is a note of anger or protest, is a loud, harsh *cack-cack-cack-cack-cack* given in bursts of varying length with the most monotonous regularity for minutes on end when intruders are in the neighborhood of the nest. The tone is different in the two sexes, the voice of the male being more wheezy and high-pitched, that of the female grating and coarser. The sound suggests a giant watchman's rattle twirled rather slowly. In the case of birds that are bold and thoroughly aroused, and therefore plunging close to the visitor, it is very wearing and disagreeable, so that after a few minutes there arises an almost irresistible desire to get away from it. When directed at another hawk, either a visiting peregrine or one of the larger Buteos or eagles, its intensely angry quality is often somewhat amusing.

"The second is a note of courtship and conversation, used when the male is calling his mate to a desirable nest site, or when they are together on a shelf; presumably it is a pleasing sound to duck hawks, however unmusical to human ears. I have usually represented it in my notes by the word *wi'-chew, wi'-chew* (or *wee'chew*), with the first syllable lengthened and heavily accented. Occasionally it is as smooth as the similar note of the flicker, although louder; but typically it is rougher and creakier than a grackle's song, or a very rusty hinge. It is the most variable of the three notes, either persuasive, amorously excited, or talkative, as the occasion requires.

"The third is a recognition or location call given when two birds of a pair are separated; a clear, high slightly ascending, wailing note that falls upon the ear and fades away again so gently that neither beginning nor end can be accurately determined, and yet its middle part has great carrying power. It can be closely imitated by singing äääää in the roof of the mouth, with the lips open, at a pitch close to second-octave F on the piano. It is a pleasing sound of itself, and to an habitual watcher at the cliffs becomes more so by association. It and the *wichew* note are used by both sexes but somewhat more extensively by the male than the female; there is no recognizable difference in tone."

Field marks.—The characteristic falcon flight, the long, pointed wings, and the long tail will distinguish it from all other hawks, except the other falcons, from which it differs in size. If one is near enough, the white throat, the peculiar color pattern of the head, and the large yellow feet are conspicuous, especially in the adult. The adult is much darker colored above than the prairie falcon, especially on the head; the young bird is also somewhat darker; but the two species are about the same size. The head markings will distinguish it from the much larger gyrfalcons.

Fall.—The fall flight of duck hawks from their more northern breeding resorts occurs early in October in New England. Referring to the flights at Fishers Island, N. Y., the Fergusons (1922) say: "A few come on the regular flight days, but, like the Pigeon Hawks, they prefer a southwest wind to any other. A strong wind is no hindrance to them, and we have come to feel that a typical Duck Hawk day is one when the wind is blowing from the south-west, with almost a hint of bad weather. * * * The adults come mixed in with the immature birds during the migration, but late in the season adults are still seen after the last of the young have gone by."

Winter.—Most of our northern-breeding duck hawks retire to the Southern States in winter. During the winter that I spent in Pinellas County, Fla., a large female duck hawk frequented the lower sandy islands about Tampa Bay; I occasionally saw it sitting on some little eminence on the islands frequented by terns and various shorebirds. A picked skeleton of a royal tern and the remains of gulls and shorebirds were evidences of its work. It remained all winter until it was shot on March 11. About the Everglades, in southern Florida, we occasionally saw a solitary duck hawk sitting on some tall tree, or flying about where small herons, ibises, and coots were abundant.

But some adults remain as far north as Massachusetts and New York all winter. It is not unusual for one of these falcons to spend the winter in one of our large cities, where it finds an abundant food supply in the large numbers of pigeons that now live in our cities. The Custom House tower in Boston, the tall buildings in New York City, the City Hall tower in Philadelphia, and the Post Office tower in Washington have all been favorite resorts for winter-resident duck hawks. Using the tallest buildings for their lookouts, they make frequent raids on the pigeons, catching them in the air and carrying them to some lofty shelf to pluck and eat them, letting the feathers flutter down into the streets. They furnish considerable entertainment for interested spectators and should be welcome visitors if they keep in check the increasing hordes of pigeons and starlings.

DISTRIBUTION

Range.—The duck hawk is cosmopolitan in its distribution, the breeding ranges of the northern subspecies being circumpolar and the winter ranges extending south to the Indian Peninsula, Africa, and southern South America, while other races occur in Malaysia and Australia. The typical race, or Old World peregrine falcon (*Falco peregrinus peregrinus*), is doubtfully casual in Greenland (see discussion by Jourdain, p. 42). The following account includes the duck hawk and Peale's falcon (*F. p. pealei*), which is confined to the North Pacific coast from the Commander and Aleutian Islands south rarely to southern California (San Diego and Pacific Grove).

Breeding range.—In North America the breeding range extends **north** to Alaska (Nome, Colville River, Camden Bay, Barter Island, and Demarcation Point); Mackenzie (Lockhart River, Melville Mountains, and probably Bernard Harbor); Keewatin (probably Fullerton and Repulse Bay); Franklin (Frozen Strait, Southampton Island, Baffin Island, and Greater Kingwah Fiord); and Greenland (Holsteinborg). **East** to Greenland (Holsteinborg, Godthaab, Frederikshaab, and Cape Farewell); Labrador (Okkak); Quebec (Wapitagun, Anticosti Island, and Percé); southeastern New Brunswick (Grand Manan); Maine (Milltown, Bangor, and Auburn); New Hampshire (probably Monadnock); Massachusetts (Mount Tom and Sheffield); Connecticut (Talcott Mountain, Meriden, and New Haven); New Jersey (Englewood); eastern Pennsylvania (Nockamixon Cliffs, Lehigh Gap, and Chickies); West Virginia (Harpers Ferry and White Sulphur Springs); Virginia (Great Falls); western North Carolina (Roan Mountain, Black Mountain, and Great Smoky Mountains); and northeastern Alabama (Fort Deposit). **South** to northern Alabama (Fort Deposit); rarely northern Arkansas (Cleburne County); Kansas (Neosho Falls, Hays, and Ellis); southwestern Texas (Chisos Mountains and Boquillas); Arizona (probably Keams Canyon and Camp Verde); and Baja California (Idlefonso Island and San Roque Island). **West** to Baja California (San Roque Island, Natividad Island, San Geronimo Island, San Fernando, Todos Santos, and Coronados Islands); California (San Diego, San Clemente Island, Santa Rosa Island, Santa Cruz, San Mateo County, Alameda, Tomales Point, and Eureka); Oregon (Fort Klamath and Newport); Washington (Quillayute Needles, Carroll Island, Flattery Rocks, and Bellingham); British Columbia (Okanagan, Masset, and Langara Island); and Alaska (Forrester Island, Admiralty Island, Aleutian Islands, Beaver Mountains, Chitina Moraine, and Nome).

Verrill (1905) stated that in 1904 a pair nested on the island of Dominica in the Lesser Antilles. While this is considered doubtful, nevertheless an adult female was collected on May 5, 1928, at Changuinola, Panama (Peters, 1931).

Winter range.—In winter the duck hawk ranges **north** with fair regularity to western Washington (Grays Harbor); southeastern British Columbia (Okanagan); northeastern Texas (Corsicana); Kentucky (Versailles and Lexington); Connecticut (New Haven, Saybrook, Milford, and Stamford); and Massachusetts (Boston). **East** to Massachusetts (Boston); eastern New York (Fire Island); New Jersey (Princeton and Long Beach); Virginia (Wallops Island); North Carolina (Cape Fear); South Carolina (Oakley Depot and Charleston); Georgia (Blackbeard Island); Florida (Lake Iamonia, Kissimmee Prairie, and Whitewater Lake); Bahama Islands (Normans Key and Watling Island); rarely Haiti (Fort Liberté); Puerto Rico (Faro de Cabo Rojo and Cartagena Lagoon); and rarely the Lesser Antilles (Anguilla, Antigua, St. Bartholomew, St. Vincent, the Grenadines, and Trinidad). **South** to rarely the Lesser Antilles (Trinidad); rarely Colombia (Bonda); and Panama (Santiago). **West** to Panama (Santiago); Guatemala (Duenas and probably Ocos); Michoacan (Los Reyes); Jalisco (La Barca and Guadalajara); Nayarit (Tres Marias); Baja California (Cape San Lucas, Santiago, Todos Santos Islands, and Natividad); California (Upland, Clovis, Bodega, and East Park); Oregon (Fort Klamath and Netarts Bay); and Washington (Grays Harbor).

Migration.—There appears to be very little regularity in the seasonal movements of this species, as dates of arrival and departure vary greatly in any one locality.

Spring migration—Early dates of spring arrival in regions north of the winter quarters are: Massachusetts—Huntington, February 3; Holyoke, February 22. Vermont—Woodstock, March 11; South Newbury, April 1. New Hampshire—Monadnock, March 19. Maine—Westbrook, March 14. Quebec—Kamouraska, March 21. Missouri—St. Louis, March 8; Mount Carmel, March 17. Indiana—Bicknell, March 9. Ohio—Columbus, March 5; Youngstown, March 8. Michigan—Grosse Isle, March 9; Silver Lake, March 10; Ann Arbor, March 10. Ontario—London, April 14; Bowmanville, April 16; Ottawa, April 17. Iowa—La Porte City, March 14; Keokuk, March 14. Wisconsin—Burlington, April 7; Lacrosse, April 8. Minnesota—Heron Lake, March 24; Lake City, March 27. Kansas—Onaga, March 23. Nebraska—Lincoln, March 12. North Dakota—Teepee Buttes, March 17. Manitoba—Aweme, April 6; Treesbank, April 16. Colorado—Loveland, March 29. Wyoming—Albany County, April 2.

Montana—Big Sandy, March 21; German Gulch, March 23. Alberta—Belvedere, April 18. Yukon—Dawson, May 18. Alaska—Pribilof Islands, March 12 (observed on St. George on January 13, 1917); Beaver Mountains, April 25.

Late dates of spring departure from points south of the breeding range are: Honduras—Swan Island, February 17. Lesser Antilles—St. Croix, March 17; St. Lucia, March 18; Trinidad, April 5. Puerto Rico—Boqueron, April 18; Cartagena Lagoon, April 25. Florida—Daytona Beach, April 28; Tortugas, May 18.

Fall migration.—Late dates of fall departure from breeding areas north of the winter range are: Alaska—Icy Cape, September 6; St. Lazaria Island, September 30; Sitka, October 1; near Aleutian Islands, October 7. Yukon—Herschel Island, August 16; Forty-mile, September 15. Alberta—Camrose, October 2. Montana—Rockcreek, October 26. Wyoming—Wheatland, October 15. Colorado—Grand Junction, December 23. Mackenzie—Fort Norman, September 30; Gravel River, October 6. Manitoba—Aweme, October 18; Treesbank, October 23. North Dakota—Argusville, October 20; Charlson, December 2. South Dakota—Arlington, November 15; Sioux Falls, November 18. Nebraska—Page, November 14; Lincoln, December 8. Minnesota—St. Vincent, October 13. Wisconsin—Burlington, November 15. Iowa—Badger Lake, November 4; Keokuk, November 12. Ontario—Toronto, October 20; Point Pelee, October 23; Ottawa, November 11. Michigan—Newberry, October 16; Rockwood, October 29; Locke, November 2. Ohio—Columbus, November 14. Illinois—Evanston, November 13. Missouri—Mount Carmel, November 12. Franklin—Five-hawser Bay, September 8; Baffin Island, September 15; Ashe Inlet, Hudson Strait, September 25. New Brunswick—Scotch Lake, October 11. Quebec—Montreal, November 13; Godbout, November 20. Vermont—Rutland, October 1. Massachusetts—West Boylston, November 12; Ipswich, November 12; Danvers, November 16.

Some early dates of fall arrival in the southern part of the winter range are: Florida—Pensacola, August 11; Miami, September 18; Key West, October 1. Puerto Rico—Anegado Lagoon, August 8. Lesser Antilles—St. Bartholomew, November 8; Barbados, November 17.

The banding files of the Biological Survey contain an interesting series of records of duck hawks that have been banded and subsequently recovered. Most of the banding has been done at Woronoco, Russell, and Huntington, Mass., and these birds have been retaken chiefly in Connecticut, New Jersey, Pennsylvania, and Virginia. One banded on September 3, 1932, at Treasure Island, N. J., was killed at McClure, Ill., on September 22, 1932, while another banded at Mohonk Lake, N. Y., on September 18, 1929, was recaptured on September 26, 1929, at Grand Island, Nebr. These are striking examples not only of a curious east-to-west flight, but also of very rapid travel. One banded at Kings Point, Yukon, on July 30, 1924, was shot at Duchesne, Utah, on February 20, 1925.

Casual records.—An easy and powerful flier, the duck hawk has been recorded many times outside of what is considered its normal range. One was reported from Port au Port, Newfoundland, in 1911, and there are several records, dating back to 1846, of specimens taken or observed on Bermuda.

Complete data are not available for many of the South American records, but notice may be made of the following countries where the duck hawk has been observed or collected: Dutch Guiana (April 19, 1922, Paramaribo); British Guiana; Brazil (Praia de Cajutuba, Sao Paulo, the Lower Amazon and Caceres in March 1909); Uruguay (Sta. Elena, Flores, and San Jose); Paraguay (Puerto Bertoni); Venezuela (Los Hermanos Islands on January 9, 1909, and Bonaire); Ecuador (Puntilla de Santa Elena, Pichincha, Pomasqui, Chaupicruz, Carapungo, El Muerto Island, and a specimen from Cocos Island of the Galapagos group, collected on January 26, 1902); Peru (Janin and Chorillos); Chile (Santeyas, and Valdivia); and Argentina (Provinces of Buenos Aires, Cordoba, and La Rioja, Los Ynglases, and Cape San Antonio and Lomas de Zamora, Buenos Aires Province).

A specimen also has been recorded that was collected about 1887 on Elizabeth Island, in the Straits of Magellan, Patagonia.

Egg dates.—Alaska to Ungava: 10 records, May 12 to July 6; 5 records, June 5 to 26, indicating the height of the season.

British Columbia: 9 records, April 13 to May 7.

Alberta and Saskatchewan: 16 records, May 6 to June 13; 8 records, May 19 to June 3.

New York and New England: 20 records, March 29 to May 23; 10 records, April 12 to 26.

New Jersey and Pennsylvania: 9 records, March 29 to May 19.

California: 28 records, March 8 to May 28; 14 records, April 8 to 23.

FALCO PEREGRINUS PEALEI Ridgway

PEALE'S FALCON

HABITS

This dark race of the peregrine falcon is none too well understood, as to its subspecific status and its distribution. Considerable doubt has been expressed as to the validity of the name, because the type is an immature bird taken, presumably, in Oregon; it is a dark-colored bird but no darker than some dark specimens from eastern localities. However, this need not necessarily invalidate the name, for the type specimen may well have been, and probably was, a migrant from the range of *pealei*, as now recognized.

The range, as now revised in the A. O. U. Check-List (1931), is approximately correct. Maj. Allan Brooks (1926), who has made a study of this group, gives the range of *pealei*, as follows: "The North Pacific islands between latitude 50 and 55, from the Skeena River mouth (British Columbia) to the Commander Islands (and adjacent coast of Kamchatka?). Probably resident throughout its range."

He gives the following characters of the race:

> It is characterized by a very heavily marked under surface in the adult and possibly greater size than in *Falco peregrinus peregrinus* and *F. peregrinus anatum*. The markings in the adult female extend up onto the jugulum in the form of tear drops and bars, not hair lines or narrow lanceolations as in other forms of *peregrinus*. In the adult male the markings are not so pronounced, but the whole lower surface is usually dusted with dark gray in addition to the bars. There is very little rufous on the lower surface in either sex. The young are very dark and may or may not have rufous edgings to the feathers of the mantle; they can be matched almost exactly by dark juveniles from the Atlantic coast.

Adults from the Queen Charlotte Islands that I have examined have the upper parts "fuscous" to "hair brown"; the under parts are white, slightly tinged with "cinnamon-buff" on the belly, heavily spotted on the upper breast, and heavily spotted and barred on the belly and flanks with black; the black bars on the flanks are as wide as the white spaces, and nearly so on the tibiae; the dark bars on the tail and its upper coverts are wider than the gray bars. Adults I have seen from the Commander and Aleutian Islands are no darker above, in fact they are somewhat lighter, in color than those from the Queen Charlotte Islands; but the under parts are whiter, less buffy, than in *anatum*, and they are more extensively spotted and streaked on the upper breast and jugulum. Young birds from the Aleutian Islands are much darker than those I have seen from the Queen Charlottes, and very much darker than the darkest of our eastern birds. Duck hawks from interior and northern Alaska and from the Pacific coast south of latitude 50° N. are clearly referable to *anatum*, as are also those from Admiralty Island and the Sitkan region.

Nesting.—The nesting habits of Peale's falcon are not essentially different from those of other peregrines. Among the Aleutian Islands in 1911 we saw these falcons on Atka, Kiska, Tanaga, and Adak Islands. At Kiska Harbor, on June 19, I watched a pair flying about some high cliffs; they were apparently building a nest on an inaccessible ledge, as I saw one of them fly up with a stick in its claws. I also saw a pair mating on Atka Island on June 13. They are apparently late breeders in that region. We did not succeed in finding any occupied nests or in securing any specimens of the birds.

We shot one bird, but it fell over a high cliff and could not be found among the piles of loose rocks at the base.

Major Brooks (1926) says:

> On the Queen Charlotte Islands the Peale Falcon is probably more abundant than peregrines are anywhere else in the world. On North Island in the breeding season one is never out of hearing of the birds. Sometimes three broods of fledglings can be heard calling from one vantage point, and probably thirty-five pairs nest on the twenty-five miles of coast-line of this small island alone.

C. deB. Green (1916), referring to other islands in this group, writes:

> The birds nearly always choose [for a nesting site] the very top of the cliff under the roots of a spruce-tree growing on the edge—in some cases quite easy of access, sometimes requiring a rope and some help. * * *
>
> Peale's Falcon, lays, of course, four eggs, like its congener the Duck-Hawk; the eggs are indistinguishable from those of the latter, being red to match the hollow of rotten wood amongst the débris of trees growing at the top or on the ledges of cliffs, at any elevation above the water-line from 20 to 500 feet. One clutch was found upon a grassy slope dividing a lower cliff from an upper one, but always amongst the roots of a spruce-tree, which gives shelter to the sitting bird in rainy weather. Only one eyrie was found differently situated, and that was on a ledge sheltered by an overhanging rock; the nest had no red rotten wood, and, interesting to note, the eggs were the palest seen.
>
> When the complete clutch is taken, before incubation begins, the bird begins her fresh set close by the first in about ten days, but if incubation has advanced it will be more like three weeks before the new set is laid.

Lucien M. Turner (1886) writes:

> This Falcon was frequently observed on Amchitka Island in the month of June, 1881; and on several occasions on Attu Island, during 1880 and 1881. It breeds on nearly all of the islands of the chain, and is a winter resident on the Nearer Group, at least. On Agattu it is reported to be very common; and, on Amchitka I knew of three nests on the ledges of the high bluffs, hanging over the sea. Any approach to the cliffs was heralded by the bird darting from the nest and circling high in the air, screaming fiercely all the while, and any attempt to shoot the birds, while flying over the water, would have resulted in the loss of the specimen, for they always flew in front of the cliffs out of gun-range.

Eggs.—The eggs are indistinguishable from those of other peregrines. The measurements of 34 eggs average 53.3 by 41.1 millimeters; the eggs showing the four extremes measure **58** by **43, 48.5** by 41, and 52.9 by **39.1** millimeters.

Plumages.—A nestling taken on Amnak Island, Alaska, on July 17, is much like the young of *anatum*, but darker; the upper parts are "fuscous" instead of "bone brown"; the under parts are more heavily marked with "fuscous", with narrower buff edgings; the head is more extensively "fuscous", less buffy, tawny, or ochraceous than in *anatum;* and the tail is broadly tipped with "pinkish buff." Subsequent plumage changes are probably similar to those of other peregrines.

Food.—Sea birds and ptarmigans seem to form the main food supply of this falcon in the Aleutian Islands. Mr. Green (1916), referring to the Queen Charlottes, writes:

> The isolated Falcons at lonely points on the coast were living chiefly upon duck, chickens, and sandpipers, but the congregation of *F. p. peali*—thirteen

eyries at the north-west corner of the main island and on the rocky shores of Langara Island, just across Parry Passage—were living entirely upon the Ancient Murrelets (*Synthliboramphus antiquus*), which were breeding there in thousands.

Nothing was found at any of the eyries but remains of Ancient Murrelets, very rarely anything but the heads, very neatly cut off and always fresh; all other remains were cleared away carefully.

Langara Island is about twenty miles in circumference, and has a pair of Falcons at a distance of every two miles apart; the whole island is a warren of Ancient Murrelets, and there are colonies of other sea-fowl at particular points and on adjacent islets, but the Ancient Murrelets predominate, and are killed by hundreds by the Falcons and by thousands by Indians, who visit the island from May to August and destroy the birds and eggs simply for food. Something in the flavour evidently pleases both the Falcons and the Indians, for neither of them seems to make war on the other fowl.

Behavior.—Mr. Turner (1886) writes:

> At Attu Island I frequently saw one of these birds join the Ravens when the latter were performing their aërial gymnastics on the approach of a gale.
>
> The Hawk endeavored to imitate the Ravens, which paid but little attention to the antics of the intruder.
>
> At Attu this Hawk is not common, though the natives assert that it is common enough at Agattu and the Semichi Islands. The natives told me that where this Hawk breeds there will also be found the nests of the Eiders. I could not believe this until a short stay at Amichitka Island forced me to recognize it as a fact, for, in each instance, the nests of Eiders were very abundant in each of the localities where the nest of this hawk was known to be. It is quite probable that the hawk selects the place with special reference to prospective young Eiders.

Winter.—Peale's falcon apparently wanders south occasionally in fall or winter. Harry S. Swarth (1933) records a specimen of this race taken at San Diego Bay on March 31, 1908. I have a bird in my collection taken 2 miles south of Colorado Landing, Lower California, on December 30, 1924, which I regard as nearly typical of *pealei*.

FALCO COLUMBARIUS COLUMBARIUS Linnaeus

EASTERN PIGEON HAWK

Plates 16, 17

HABITS

Our American merlins, or pigeon hawks, have been subdivided by the latest authorities into four races. There are three quite distinct forms, but one of these, *suckleyi*, may be only a color phase, as it seems to have no distinct range in which it alone is found; and the fourth, *bendirei*, is to my mind only an intermediate between the darker and the lighter races, and is too near the eastern race to warrant recognition. This matter is discussed further under these two forms. The range of the eastern form extends roughly north to the limit of trees and west to the eastern edge of the prairie regions and to Alaska. Some form of the pigeon hawk is to be found at some season of the year over practically all the North American Continent, except in the treeless Arctic region.

Spring.—To most of us the pigeon hawk is known only as a spring and fall visitor, as its breeding range is mainly north of the United States and as it spends its winters in the Southern States and beyond our borders. In New England the spring migration occurs mainly during the last half of April and the first half of May, coinciding with the main flight of small birds on which it feeds.

Nesting.—My experience with the nesting habits of the pigeon hawk has been limited to two nests found on the south coast of the Labrador Peninsula and one found in Newfoundland. In each case our attention was attracted to the nesting site by the noisy behavior of the birds, flying about nervously and screaming excitedly even while we were some distance away. On June 3, 1909, while we were walking along the rocky shore of Eskimo Island, Canadian Labrador, we heard the cries of a small hawk; on climbing up to the edge of the spruce woods, we saw a pigeon hawk flying about, or perching on the top of a tall spruce and flying down occasionally into the woods. I began a careful search through the dense thickets of spruces and firs, where I finally found, in a thicket of taller spruces, what looked like an old crow's nest, about 14 feet up in a red spruce. The hawks were not in evidence, but I climbed up to the nest and was surprised to find three beautiful eggs. It had long been my hope to collect a set of pigeon hawk's eggs, and four days later I returned and gratified the wish by taking a handsome set of five eggs and photographing them in the nest. The nest was apparently a very old crow's nest that had since been used by red squirrels, as the deep cavity had been filled with rubbish, including numerous seed scales from the cones of the white spruce. It rested on horizontal branches close to the trunk of the tree and was made of rather large, dead sticks, interwoven with soft mosses; the center had been hollowed by scraping out the rubbish, which had become quite rotted; very little lining had been added, merely a few small pieces of fine twigs and lichens; a few bits of down were visible in and around the nest and on the surrounding branches. The nest measured 16 by 14 inches in outside and 8 by 8 inches in inside diameter; the outside height was 9 inches and the inner cavity was 2½ inches deep (pl. 16).

While fishing for trout in the Mingan River, on June 17, 1909, we were attracted to another nest by the cries of a pair of pigeon hawks. This was somewhat differently located in a large, rather open space in heavy spruce timber, where there were a few tall, scattered spruces. My companion, Dr. Charles W. Townsend, saw the male falcon fly into a tall black spruce and out again, in which a large nest was visible; he rapped the tree and the female flew from the nest. The tree was about 45 feet high and measured 58 inches in circumference near the base, a very large tree for this region. The nest was about 24 feet from the ground and 10 inches out from the trunk on a horizontal limb, well sheltered from above and on the north and east sides by thick foliage. It was apparently a new nest, made of dead sticks and lined with masses of soft, fine rootlets, a few small twigs and pieces of bark, and a few feathers. It measured 20 by 15 inches in outside and 9 by 8 inches in inside diameter; it was hollowed to a depth of 2 inches and was only 5 inches high over all. The four eggs that it contained had been incubated for about a week.

My third nest was in an entirely different situation, and we were puzzled for a long time to find it, although the hawks advertised it in no uncertain terms. On June 19, 1912, while we were hunting around Gafftopsail in Newfoundland, a pigeon hawk flew out from a large tract of heavy spruce and fir woods, yelling and showing every sign of anxiety. But, though I searched those woods thoroughly for over an hour, no occupied nest could be found. Meantime, my guide, who was sitting out on an open hillside to watch the birds, saw the male falcon hover for an instant over a little hummock on the hillside. As he walked toward it the female flushed from her nest when he was about 100 yards from it. The nest, containing five eggs, was on the ground in a roomy hollow under some low, scraggly firs and spruces only a few inches high (pl. 17). The hollow was lined with bits of twigs and a few feathers.

I heard of two other cases where these falcons had nested on the ground in that vicinity. Also, out of seven sets of pigeon hawks' eggs in W. J. Brown's collection, three of them were taken from nests on the ground, all from this same general region. He also refers, in his notes, to a nest found in Matane County, Quebec, that was about 50 feet up in a spruce tree.

Dr. Harrison F. Lewis (1922) writes:

> On June 22, I found, a few rods west of the first falls of the Little Natashquan River, a rather unusual nest of this species. It was on the ground, among the Reindeer lichen, on the summit of a small knoll of gentle slope. A black spruce "tree" which had grown here for many years, until it had attained a height of about 3 feet and a width of 6 feet, had died, apparently two or three years previously, leaving a confused snarl of stiff dead limbs. The Pigeon Hawks had placed their nest beneath this shelter. The nest, which was about 6 inches across and 1 inch deep, was a depression in the soil, here composed of sand and rotten wood, and was lined with a few small scales of bark, picked by one or both of the Hawks from the base of the trunk of the sheltering "tree," as was clearly indicated by the recent scars on that trunk. Four eggs rested on these bits of bark. One Hawk flew from the nest when I approached it, and it and its mate scolded me vigorously, charging repeatedly to within a few feet of me, as long as I remained in the vicinity.

Dr. Lynds Jones wrote to Major Bendire (1892) "that he found a nest of this species near Grinnell, Iowa, on April 28, containing four eggs. They were placed in a hole in an American linden tree about

8 feet from the ground. The nest was made of dry grasses, fibrous bark, and a few feathers."

Roderick MacFarlane (1891) writes:

> This falcon ranges along the Anderson River almost to the Arctic coast of Liverpool Bay. Several of their nests had apparently been built by them on pine trees, and others on the ledges of shaly cliffs. The former were composed externally of a few dry willow twigs and internally of withered hay or grasses, etc., and the latter had only a very few decayed leaves under the eggs. * * * I would also mention the following interesting circumstance: On the 25th of May, 1864, a trusty Indian in my employ found a nest placed in the midst of a thick pine branch of a tree at a height of about six feet from the ground. It was rather loosely constructed of a few dry sticks and a small quantity of coarse hay. It then contained two eggs. Both parents were seen, fired at, and missed. On the 31st he revisited the nest, which still held but two eggs, and again missed the birds. Several days later he made another visit thereto, and to his surprise the eggs and parents had disappeared. His first impression was that some other person had taken them. After looking carefully around, he perceived both birds at a short distance, and this led him to institute a search which soon resulted in finding that the eggs must have been removed by the parent birds to the face of a muddy bank at least forty yards distant from the original nest. A few decayed leaves had been placed under them, but nothing else in the way of lining. A third egg had been added in the interim. There can hardly be any doubt of the truth of the foregoing facts.

H. Kirke Swann (1936) states that the pigeon hawk sometimes nests "under the roofs of deserted buildings."

Eggs.—The number of eggs laid by the pigeon hawk is usually four or five, oftener five than four, very rarely six, and occasionally only three. They vary in shape from short-ovate to oval or nearly elliptical-ovate. The shell is smooth but without gloss. They look almost exactly like small duck hawks' eggs, showing the same rich and brilliant colors, but they average somewhat darker. Bendire (1892) describes them very well, as follows: "The ground color when visible is pale creamy white as a rule, and is hidden by a reddish brown suffusion of various degrees of intensity, and this, again, is finely marked or boldly blotched, with different shades of burnt umber, claret brown and vinaceous rufous. These markings are generally equally and profusely distributed over the entire egg, and are superficial; occasionally they are most distinct about one of the ends, being disposed in the shape of a wreath."

I have seen some that were sparingly spotted with dull browns and buff; and one set that was nearly immaculate white. The measurements of 55 eggs average 40.2 by 31.3 millimeters; the eggs showing the four extremes measure **44.5** by 33, 40.4 by **33.1**, **37.5** by 33, and 38 by **30** millimeters.

Plumages.—When first hatched the young pigeon hawk is rather thinly covered with short, creamy-white down, mixed with pure white; this is replaced later by longer down, brownish gray or grayish white above and nearly pure white and longer down below. In a young bird, 18 days old and nearly fully grown, the primaries have begun to burst their sheaths and are about 1 inch long; the tail feathers are in about the same condition, but are only about three quarters of an inch long; the head and body are still wholly downy, except that feathers are appearing on the scapular region.

In fresh juvenal plumage, the crown is "russet", broadly streaked with black; the mantle is "bone brown" to "clove brown", with narrow "russet" edgings, and with a purplish sheen; there are some tips and concealed spots of "orange-cinnamon" on the scapulars and remiges; the tail is black, or slightly brownish, with narrower gray bars than in the adult, and broadly tipped with "pinkish buff"; the under parts are "cinnamon" to "cinnamon-buff", broadly streaked, except on the chin and throat, with "sepia" or "bister."

The sexes are alike in this plumage, which closely resembles that of the adult female. This plumage is worn for nearly a year with no change, except by wear and fading. By late in winter or early in spring the upper parts have faded out to "olive-brown", "buffy brown", or even "drab"; and the under parts are white, or creamy white, streaked with "snuff brown", or even paler browns.

In April or May, when the bird is less than a year old, the molt into the adult plumage begins; the body plumage is molted first and the wings and tail later. I have seen molt in the wings in June, but usually it does not begin until July. The complete molt may not be finished until November.

In adult plumage the sexes are quite different. In the male the upper parts are "plumbeous", darkest on the upper back; the tail is mainly black, tipped with grayish white, and with broad "cinereous" bands; the streaks on the under parts are black, or nearly so. The female is brown above, uniform "warm sepia" to "bister"; the tail is "olive-brown" to "clove brown", with narrower, pale buffy bars; and the streaks on the under parts are "sepia."

The annual, complete molts of adults are irregular and prolonged, much as in the young birds. Witherby's Handbook (1924) says, of the European merlin, that the complete molt begins with the wing feathers in June and is completed usually in November, but sometimes not until December or even January. It also says that "what certainly appears to be a second moult confined to body feathers takes place Feb.–March and occasionally not finishing until April." It seems to me that this merely shows that the body molt precedes the wing molt. I once collected a breeding pair of pigeon hawks on June 17; the male was in fully adult plumage, but the female was mainly in immature plumage, much worn, and was molting the body plumage and the wings. This shows that sometimes at least these falcons, like some other hawks, become sexually mature before they acquire the adult plumage. This female had laid a set of four fertile eggs.

Food.—The pigeon hawk is mainly a bird eater. Dr. A. K. Fisher's (1893b) report on the contents of 56 stomachs says that 2 contained poultry, 41 small birds, 2 mice, and 16 insects. The following birds have been recorded in its food: Leach's petrel, green-winged teal, woodcock, snipe, sandpipers, Eskimo curlew, plovers, small domestic chickens, California quail, ptarmigans, pigeons, doves, chimney and black swifts, flickers, jays, bobolink, meadowlark, blackbirds, grackles, various sparrows, waxwings, swallows, warblers, vireos, gnatcatchers, brown creeper, nuthatches, kinglets, pipit, robin, and thrushes. Other things listed include pocket gophers, squirrels, mice, bats, toads, lizards, snakes, dragonflies, butterflies, moths, grasshoppers, crickets, beetles, spiders, crawfishes, scorpions, and caterpillars. That this little falcon is able to catch such rapid fliers as swifts and swallows, or such nimble insects as dragonflies, speaks well for its powers of flight.

Its boldness and courage are shown in its attacks on the larger species. It has been known to enter a pigeon cote and kill and carry off a pigeon.

Dr. Fisher (1893b) says that "pigeons, flickers and grackles are about as large birds as it usually attacks, though Dr. Dall in one instance saw it kill a ptarmigan, and Dr. E. A. Mearns speaks of a specimen shot in the act of destroying a hen." John Murdoch (1877) mentions four pigeon hawks that came out to a vessel in the Gulf of St. Lawrence: "The first that appeared had a Leach's petrel, dead, in his talons. He alighted with this, on the fore crosstrees, and proceeded to eat it." Dr. Elliott Coues (1861) saw one of these hawks, at Henley Harbor, Labrador, "foraging among the immense flocks of curlews (*Numenius borealis*), which then covered the hills in the vicinity."

Thomas McIlwraith (1894) once saw one dash into a flock of blackbirds; "how closely they huddled together, as if seeking mutual protection, but he went right through the flock and came out on the other side with one in each fist."

Dr. B. H. Warren (1890) writes: "Two Pigeon Hawks during the late fall lurked about the southern suburbs of the borough of West Chester, preying at regular intervals on the pigeons of a blacksmith. In one week the hawks killed or drove away fifty of the birds. The hawks would enter the boxes and take from them the pigeons."

Edward H. Forbush (1927) says of its hunting:

> It likes to take a stand on post, pole or tree where, having an unobstructed view, it can survey at leisure the wild life of the locality, and from which it can launch forth in swift pursuit of some passing bird, or plunge into some near-by thicket after some timid warbler or sparrow. I never saw one descend almost perpendicularly from a great height upon its prey, as the Duck Hawk often does,

and I have not seen one actually strike it prey. Its usual method is to chase the prospective victim, which in most cases it can overtake with apparent ease; but in my experience it is frequently baffled by the sudden doublings of the pursued, until it gives up the chase or the hunted bird escapes by suddenly diving into water or dense shrubbery. I have seen a Pigeon Hawk chase a small flock of Common Terns without even touching one, and once in Florida I watched one pursuing for a long time a flock of Sandpipers, but it was unable to catch one as long as the chase was maintained within my field of vision. The hawk seemed to be able to overtake them and to follow their flash-like turns quite closely, but could not lay its claws on a single bird; snipes and sandpipers continually escape, and probably the hawk cannot often take a vigorous shore bird in full possession of its faculties, but a weak, sickly or wounded bird would stand little chance before it.

Dr. Charles W. Townsend (1930) says:

> I was watching, at Plum Island, a flock of twenty-one Semipalmated Sandpipers and a few Sanderlings, when they suddenly rose and flew off from the beach, close to the water, pursued by a falcon. Suddenly the falcon shot up for about ten feet into the air, banking with its wings and tail widely spread, then darted down with a splash into the water, submerging its outstretched legs, its belly and part of one wing. Rising with a sandpiper in its talons, it flew to an old stump washed up on the shore where it proceeded to tear out the breast and wing feathers of its victim.
>
> This is what we saw but it is evident that it had struck down the sandpiper in flight so quickly that our eyes failed to follow, and had immediately turned to pick it up. The victim was a Semipalmated Sandpiper and the falcon a Pigeon Hawk.

I once saw a pigeon hawk flying with some small object in its talons, probably a mouse, which it was apparently eating on the wing. Holding it forward and downward in one foot, it occasionally bent down its head and tore off a bit without slackening its speed. Johan Beetz, of Piastre Bay, Quebec, a close observer of birds, told us that the male feeds the female during the incubation period. He said that this is often accomplished on the wing; the male, having secured a small bird, or mouse, flies toward the nest and calls to his mate, who flies out to meet him; mounting high in the air, 20 yards or so above his mate, he drops his prey; she darts in and seizes it before it reaches the ground, turning over on her back beneath it and seizing it in her talons from below.

Lewis O. Shelley sends me the following note: "April 30, 1931, late in the afternoon, when two white-throated sparrows were feeding by one of my bird-banding traps, a pigeon hawk alighted in a large cherry tree. It could evidently hear the sparrows while not seeing them. There was a hedge of alders along the brook just beyond my traps; after a few minutes of unavailing watching on the hawk's part, because the sparrows had detected its presence and 'froze', it surprised me by flying headlong into the alders with a great confusion, in an effort to frighten the birds to flight. One ran directly into a trap and 'froze', and did not move for ten minutes, even after the hawk had gone; the other moved, as the hawk apparently intended, and a sudden swoop from the hedge, a screamed cry from the whitethroat, and the hawk had its prey. This seemed a daring way of frightening intended prey to take wing."

Behavior.—The flight of the pigeon hawk is swift and dashing, like that of the larger falcons. Its trim body is propelled at tremendous speed by the rapid motion of its long, pointed wings. Few, if any, birds can escape it in straightaway flight; even the black swift, one of our fastest-flying birds, has been captured by it. But the prowess of this and other falcons has been somewhat overestimated by admiring observers; it is not always successful, and it often fails to capture birds of much slower flight that are skillful at dodging. William Brewster (1925) tells of a pigeon hawk's attempt to capture a titlark:

> Titlarks were particularly abundant. As I was watching not less than one hundred of them circling over the marshes, a Pigeon Hawk dashed repeatedly into the midst of the crowded flock without capturing any of its members, although one was finally separated from the rest, and pursued for upwards of five hundred yards. The Hawk rose above and stooped down at it fully twenty times in quick succession, with lightning speed and faultless grace. More than once I thought it had it in its talons, but it always eluded them at the critical moment by an abrupt turn or twist. This he could not seem to follow, but invariably descended straight for several yards farther before checking his impetus, to mount and swoop again. All the while the Titlark was nearing, if by devious courses, a dense thicket of alders into which it plunged at length, to be seen no more.

He also witnessed the repeated attempts of a pigeon hawk to capture one of a small flock of blue jays; in spite of his swift and spectacular dashes, the falcon always failed, as the jay always succeeded in dodging or dropping into a treetop, where the falcon did not attempt to attack it; a sharp-shinned hawk would have dashed in after it.

Taverner and Swales (1907) relate the following incident, witnessed by W. E. Saunders: "We had fired at and wounded a Black-bellied Plover which was flying over Lake Erie. The wounded bird was at once pursued by this falcon. Attaining a height of thirty or forty feet above the plover, who was only five or six feet above the water, the falcon swooped and missed—the plover dodging. Again he rose and swooped, and again missed. This was repeated perhaps six times, the birds drawing away northeast towards the mainland, when finally the falcon was successful and struck the plover, knocking him into the water. He then rose, and with a careful swoop, picked him up and flapped away to the Point and we saw him no more."

Referring to the flight of this falcon, Ernest Thompson Seton (1890) says: "One trick of flight they had in common with the Whisky John, Shrike and others, namely, flying low over the ground towards a post or stump, and just as one expects to see them strike the bottom of it there is a sudden spreading of tail and wing, and the bird gracefully bounds straight up to the top and alights there. This species will sometimes hover, though they do not make such a practice of it as the Sparrow Hawks."

Richard M. Bond (1936a) made some interesting observations on the speed in flight of some pigeon hawks that he was training for falconry. He found that a trained bird, in coming to the lure, flew at the rate of 29.9 miles an hour, but estimated that, in pursuit of a flying quarry, it would fly about 50 percent faster. He says, also: "In comparing it with birds it was attempting to capture, it was observed that the Pigeon Hawk flew faster than quail (*Lophortyx californica*) or Meadowlarks (*Sturnella neglecta*), and more slowly, at least in a rising flight, than Horned Larks (*Otocoris alpestris*). It could catch a shrike (*Lanius ludovicianus gambeli*) in a long course free from cover; it was keener after shrikes than after any other bird. It could catch, bring down and kill a dove (*Streptopelia risoria*), or even a strong adult common pigeon if released within about 50 feet, but was easily outdistanced by these birds after they had attained top speed."

Pigeon hawks are notoriously bold, fearless, and unsuspicious; they allow a close approach when perched and will fly quite near a man in the open; hence they are often shot. About their nesting sites they are far too solicitous for their own welfare. At every one of the three nests that I have seen the birds came flying out to meet us long before we reached the vicinity of the nest, crying in distress, advertising the proximity of the nest, and encouraging us to hunt for it. While I was examining the nests the birds were most solicitous and bold, flying about the tree, perching on nearby trees, sometimes darting past or down at me in swift falcon swoops, and sometimes circling with a slow, hovering flight, their sharp, pointed wings vibrating rapidly; and they were constantly cackling in their harsh, shrill, chattering notes.

W. J. Brown (1912) had similar experiences in Newfoundland, for he writes: "I might here state that the Pigeon Hawk is probably the most curious and inquisitive of the Raptores. The sectionmen on the railway told me that they were always greeted by a pair of Pigeon Hawks when they passed down in the hand car, although the nest was a quarter of a mile off in the woods. * * * One day in June, 1911, we pitched our camp out on the barrens. A pair of Pigeon Hawks, which had their nest on the side of a mountain one mile away, observed the smoke from our fire and immediately came over our heads, uttering alarm notes."

Its behavior with other species is no less interesting. Dr. E. W. Nelson (1887) in Alaska "saw one of these birds dart down and strike its talons into the back of a Burgomaster Gull (*Larus glaucus*) as the latter was flying over the sea; after holding on for a moment—the gull continuing its flight unimpeded—the falcon let go, and rising almost directly up for 30 or 40 yards made off." Harold H. Bailey (1906) saw one chasing a red-billed tropicbird on the west coast of Mexico; he also saw it put to flight gulls and caracaras that were feeding on carcasses. William G. Fargo writes to me that on a long, narrow lake in Florida he saw a number of kingfishers strung along at intervals, and practically every one of them was attended by a pigeon hawk, sitting some 10 or 20 yards away; and when the kingfisher moved the hawk went along too. Mr. Brewster (1925) witnessed the following peculiar behavior of a pigeon hawk:

> He was either playing or fighting with a Crow, the former I thought, for although the behaviour of both birds was rough and aggressive, it seemed to represent mutual participation in a sportive game curiously regulated and much enjoyed. Thus the successive lungings and chasings were not either one-sided or haphazard, but so conducted that each bird alternately took the part of pursuer and pursued, and when enacting the latter rôle gave way at once, or after the merest pretence of resistance, to flee as if for its life, dodging and twisting; yet it was prompt enough to rejoin the other bird at the end of such a bout, when the two would rest awhile on the same stub, perching only a few feet apart and facing one another, perhaps not without some mutual distrust. During these aërial evolutions the Hawk screamed and the Crow uttered a rolling croak, almost incessantly. They separated and flew off in different directions when my presence was finally discovered.

James S. Hine (1919) picked up, in Alaska, "a pigeon hawk that had been in an encounter with magpies. The hawk received such severe treatment that it was unable to fly away and it allowed me to walk up to it. The single magpie which was engaging the hawk when I first realized that a fight was on flew gracefully away on my approach to join six others of its kind which, very likely, had been helping in a common attack upon their enemy."

Voice.—The cackling notes heard near the nest reminded me, in form at least, of the protesting notes of the sharp-shinned hawk, though they were louder and harsher. Dr. Townsend (1920), who was with me, recorded the cry as "a rapidly repeated *wheet, wheet, wheet* varied to a *ki, ki, ki,* harsher in the female than in the male." Ora W. Knight (1908) records the same notes as "an angry *cac, cac, cac, cac, cac* varied by a shrill piercing *ki-e-e-e-e-e.*" Mr. Brewster (1925) heard one "uttering, while still on the wing, a rapidly delivered *kla, kla, kla, kla, kla, kla* almost precisely like the familiar outcry of the sparrow hawk."

Field marks.—The falcon form and manner of flight are characteristic. It could hardly be confused with the larger falcons, but it might easily be mistaken for a sparrow hawk, unless the colors could be seen plainly; the brilliant colors and the conspicuous markings of the sparrow hawk are very distinctive with any reasonable amount of light; in the pigeon hawk the slaty-blue back of the adult male and the dark brown back of the female and young bird are distinguishable only in a good light, but the black tail, with whitish bands, is more conspicuous.

Fall.—It is during the fall migration that most of the pigeon hawks are seen. They come straggling along from September to November, but the height of the migration comes late in September and early in October, together with the heavy flight of small land birds. At that season they are oftenest seen in open country, along the borders of streams or large bodies of water, or along the seacoast. A. L. and H. L. Ferguson (1922), referring to Fishers Island, N. Y., say: "The Pigeon Hawk is very common at the Island during migration. These small falcons prefer a southwest wind to fly on, though numbers come along on a northwest wind. They feed early in the day, and rarely is one collected that is not found to be packed full of birds. They are very savage, and are ready to fight at any time, either with another Pigeon Hawk or a decoy owl. At the decoy we have seen one return seven times, dashing in and squealing, but never striking. They decoy better than the Sharpshins, and when once near the owl are not afraid of a person. The young birds migrate first, and the adults later, like the Sharp-shinned Hawk."

Lucien M. Turner's latest date for Fort Chimo, Ungava, where the species is rare, is September 25. Arthur T. Wayne (1910) gives the dates for the migration through South Carolina as ranging from September 13 to November 7. He says: "It is most frequently seen in October, when large flights sometimes occur, as on October 10, 1903, when I witnessed an enormous migration lasting through the whole day. Nearly all of these hawks were flying beyond gun shot and but one specimen was taken. Adult birds are very rarely seen or taken, and a male secured April 13, 1900, and a female taken November 7, 1898, are the only adult birds I have ever seen. Although this species is said to 'winter in Massachusetts and to the southward' it certainly does not occur at that season on the coast of South Carolina."

Ivan R. Tomkins writes to me that he has seen it near Savannah, Ga., "all through November, and once on January 24." Probably it does not spend the winter regularly much north of Florida, where it is fairly common at that season, arriving during the latter part of September and remaining until April.

DISTRIBUTION

Range.—The species is circumpolar, Old World forms breeding from Iceland and the British Isles, across northern Europe and Asia, to Kamchatka and wintering south to northern Africa, India, Turkestan, China, and Japan. The North American races breed from Alaska across Canada to Newfoundland and winter south to the West Indies and northern South America.

Breeding range.—In North America the pigeon hawk breeds **north** to Alaska (Kobuk River, Gens de Large Mountains, and possibly

Demarcation Point); Yukon (La Pierre House); Mackenzie (Peel River, Fort Goodhope, Fort Anderson, Fort Rae, and Hill Island Lake); northern Manitoba (Lake du Brochet and Fort Churchill); northern Ungava (Chimo); and Labrador (Okak). **East** to Labrador (Okak and Groswater Bay); eastern Quebec (Romaine); Newfoundland (Deer Lake and St. Johns); Prince Edward Island (North River); and Nova Scotia (Halifax). **South** to Nova Scotia (Halifax); southern New Brunswick (St. Stephen); Maine (Dover); southern Quebec (Quebec) ; southern Ontario (Charlinch and Lake Joseph); probably Ohio (Ashtabula County); rarely Iowa (Grinnell, probably Iowa City, and probably Sioux City); Colorado (Summit County and Fort Lewis); southwestern Wyoming (Fort Bridger); northern Utah (Wasatch Mountains); northern Nevada (Buffalo Creek); and southern Oregon (Lake Malheur and Klamath Lake). **West** to Oregon (Klamath Lake, Fort Klamath, and Newport); Washington (Bumping Lake, Tacoma, and Wrights Peak); British Columbia (Chilliwack, Okanagan, and Glenora); and Alaska (Chitina River, Seldovia, Nogheling River, Mount McKinley, Jennie Creek, and Kobuk River).

Winter range.—In the East most of the pigeon hawks retire in winter **south** to the Gulf States, the Caribbean region, and northern South America. Nevertheless, frequency of records in December and January actually extends the range much farther north.

At this season the species has been recorded **north** to southern British Columbia (Okanagan); southeastern Washington (Walla Walla); Utah (St. George); northwestern Wyoming (Yellowstone Park); Colorado (Plateau Creek and Boulder); Nebraska (Crawford and Neligh); rarely Iowa (Sioux City, Ashton, and Keokuk); Illinois (De Kalb, Urbana, and Rantoul); probably rarely Indiana (Bicknell and Richmond); rarely southern Ontario (Toronto and Ottawa); rarely southern Quebec (Montreal); and rarely southern Maine (Portland). **East** to rarely southern Maine (Portland); rarely Connecticut (New Haven); rarely Maryland (Westwood); rarely South Carolina (Charleston); Florida (Gainesville, New Smyrna, Miakka, and Fort Myers); Bahama Islands (New Providence); Dominican Republic (Monte Cristi, Moca, Miranda, and La Vega); Puerto Rico (Mayaguez and Cartagena Lagoon); and the Lesser Antilles (Anguilla, Antigua, probably St. Vincent, probably Barbados, and Trinidad). **South** to the Lesser Antilles (Trinidad); northern Venezuela (Altagracia and Caicara); and rarely Peru (Trujillo). **West** to rarely Peru (Trujillo); Ecuador (Cuenca, Canar, Zambiza, and Esmeraldas); Colombia (Medellin); Panama (Calobre); Costa Rica (San Jose); Oaxaca (Tehuantepec); Puebla (Chietla); Sinaloa (Mazatlan); Baja California (La Paz); California (San Diego, Buena Park, Santa Barbara, San Jose, Marysville, and Willows); Oregon (Portland);

Washington (Quilcene, Seattle, and Smith Island); and British Columbia (Okanagan).

The range above outlined combines the four races currently recognized as North American. The eastern pigeon hawk (*Falco columbarius columbarius*) breeds in the eastern part of the range west to the eastern border of the Great Plains and winters south through the West Indies and eastern Mexico to northwestern South America. The black pigeon hawk (*F. c. suckleyi*) is found during the nesting season only on the coastal islands of southern Alaska and British Columbia, wintering south rarely as far as San Francisco Bay. Richardson's pigeon hawk (*F. c. richardsoni*) occupies the Great Plains region from southern Alberta and Saskatchewan south in winter through Colorado and New Mexico to Texas and probably northwestern Mexico. The western pigeon hawk (*F. c. bendirei*) breeds from northern Alaska, Yukon, and western Mackenzie south to Saskatchewan, Alberta, and British Columbia and through the mountains to northern California, wintering south through California to New Mexico, northern Mexico, and Baja California.

Spring migration.—Early dates of arrival north of the winter range are: New Brunswick—Scotch Lake, April 2; St. John, April 7. Nova Scotia—Pictou, March 26. Prince Edward Island—North River, April 16. Newfoundland—Placentia Bay, February 13. Wisconsin—Milwaukee, March 10; Elkhorn, March 15; Whitewater, March 17. Minnesota—Cottonwood County, March 20; Heron Lake, March 27; Wilder, April 2; White Earth, April 12. South Dakota—Vermillion, March 11; Brookings, March 22; Yankton, March 25. North Dakota—Argusville, March 25; Larimore, April 6; Bathgate, April 9. Manitoba—Margaret, March 31; Killarney, April 1; Treesbank, April 7; Aweme, April 9. Saskatchewan—Eastend, March 15; South Qu' Appelle, March 18; Skull Creek, March 22; Muscow, March 25. Mackenzie—Fort Simpson, April 25; Fort Providence, April 27. Idaho—Coeur d'Alene, April 16. Montana—Terry, March 7; Fortine, April 16 (one seen January 15, 1931). Alberta—Alliance, April 11; Nanton, April 13; Stony Plain, April 15; Fort McMurray, April 21. Alaska—mouth of Stikine River, April 19; Kuiu Island, April 25; Strelna, May 8; Husbagah, May 10; Fort Yukon, May 13; St. Michael, May 18; Kowak River, May 19.

The last individuals appear to leave the southern parts of the winter range in March and April. Some late dates of departure from this region are: Virgin Islands—St. Croix, April 28. Puerto Rico—Lajas, April 1. Dominican Republic—Lake Enriquillo, March 5. Florida—Key West, April 3; Pensacola, April 22; Dunedin, April 30. Louisiana—Chenier Tigre, March 10.

Fall migration.—Late dates of fall departure from the northern parts of the breeding range are: Alaska—Unalaska, September 25;

Taku River, September 26; Admiralty Island, September 30. Yukon—mouth of Moose River, October 1. Alberta—Calgary, October 14; Fort McKay, October 15; Belvedere, October 18. Montana—Big Sandy, September 30; Fallon, October 22. Mackenzie—Fort Resolution, September 27; Grand Detour, Slave River, October 3; Roche Trempe-l'eau, October 8. Keewatin—Oxford House, September 10. Saskatchewan—Eastend, October 4. Manitoba—Oak Lake, October 19; Ninette, October 28; Killarney, November 4; Aweme, November 15. North Dakota—Argusville, October 14; Grafton, October 18. South Dakota—Yankton, October 16; Forestburg, October 24; mouth of the Vermillion River, October 25. Minnesota—Minneapolis, October 6; St. Vincent, October 11; Virginia, October 16. Wisconsin—Shiocton, October 9; New London, October 14; North Freedom, October 30. Prince Edward Island—North River, October 3. Nova Scotia—Pictou, October 17; Halifax, November 4. New Brunswick—Scotch Lake, November 3; St. John, November 5.

Early fall arrivals in the southern part of the winter range are generally in September and October. Among such are: Florida—Pensacola, September 4; St. Johns County, September 15; Wakulla County, September 27. Puerto Rico—Mayaguez, October 1. Venezuela—Culata, September 18.

The banding files of the Biological Survey contain two records that throw light on the movements of this species. Both birds were banded at Rosebud, Alberta, and are for the subspecies *richardsoni*. One banded on July 8, 1930, was shot in the Gila Valley, near Stafford, Ariz., on December 12, 1930, while the other, banded on July 6, 1931, was recaptured near Tucson, Ariz., on January 28, 1933.

Casual records.—The pigeon hawk is probably a fairly regular fall and winter visitor on Bermuda, but only two records are now available. One was seen on December 2, 1874, and the following day a specimen was obtained. Another was taken on March 23, 1919.

Egg dates.—Arctic America: 8 records, May 25 to June 29. Alberta to Manitoba: 19 records, May 7 to June 6; 10 records, May 18 to June 4, indicating the height of the season.

Ontario to Newfoundland: 14 records, May 18 to June 22; 7 records, May 24 to June 9.

Labrador: 8 records, May 15 to June 30.

FALCO COLUMBARIUS SUCKLEYI Ridgway

BLACK PIGEON HAWK

HABITS

This dark race of the pigeon hawk is supposed to be resident in the humid, northwest-coast region, but the limits of its restricted range are none too well known. It is supposed to breed in British

Columbia and to wander only rarely as far south as northern California. Major Bendire (1892) writes:

> I am quite positive, however, that an occasional pair breeds in the vicinity of Fort Klamath. On May 9, 1883, while en route from this post to Linkville, Oregon, I observed a pair of these birds in the large open pine forest about midway between the two points. I had halted my party to let the horses graze, and, while resting, my attention was attracted to the male, by its incessant screaming in the trees overhead; this also brought the female around, and she was equally as noisy. It was clear that they had a nest in the vicinity, either in the tall pines or in a cliff about 400 yards distant, but a careful search instituted by the members of my party and myself failed to reveal it. Both birds were rather shy, but I finally succeeded in killing the male, a very handsome adult specimen.

J. H. Bowles (Dawson and Bowles, 1909) says: "Black Merlins are fairly common thruout the country lying between the Cascade Range and the Pacific Ocean [in Washington]. They are most numerous during migrations, but a few pairs remain with us during the summer for the sake of raising a family.

"During the fall and early spring they are most often to be met with in the open prairie country, and on the extensive tide flats that are to be found along Puget Sound. In such localities there is always an abundance of the smaller migratory birds, which seem to make up almost the entire sum and substance of their food supply."

S. F. Rathbun has very kindly looked over for me the pigeon hawks in local collections and reports that all the specimens of *suckleyi*, taken in the vicinity of Seattle and Tacoma, Wash., were migrant or winter birds, September to March. From this he infers that "quite likely, in this locality, the bird is much more of a transient than a resident, although our notes, some thirty years ago, show that for several seasons we saw the species at times about the city in the summer months."

Dr. George M. Sutton writes to me that he shot an exceedingly handsome, richly colored male of this race, on June 16, 1934, about three miles north of Blue River, British Columbia. The stomach contained "only the remains of a Vaux's swift." The gonads were considerably enlarged. He says: "Judging from this record, and from a similar one made by Taverner in an earlier year, I am inclined to think this bird may nest *far in the interior*, as well as, or perhaps instead of, along the coast, as has been supposed."

Nesting.—Mr. Bowles (Dawson and Bowles, 1909) writes:

> So far as known no positively identified eggs of the Black Merlin have ever been taken, and only two nests have been reported to me, both of which were in inaccessible cavities high up in decayed trees. One of these that I personally visited in June was placed in a lone cottonwood tree in the valley of the Puyallup River, and contained young that were learning to fly. The young paid no attention whatever to me, but the parents sat overhead looking down at me and uttering plaintive whimperings, altho seemingly pretty well assured that I could not reach them. The note sounded not unlike the *kik-kik-kik* call of the Flicker, only very much more subdued, and is the only sound I have ever known this bird to make at any time.

There is a set of four eggs in the A. M. Ingersoll collection, taken by L. D. Rice near Sitka, Alaska, on May 27, 1887, from a "nest of sticks, lined with leaves and feathers, built on top of a rock about eight feet high." These eggs are now stored in the museum of the San Diego Society of Natural History.

Plumages.—The molts and plumages evidently follow the same sequence in the black pigeon hawk as in others of the species, but *suckleyi* is much darker than *columbarius* in all plumages. In the juvenal plumages of both sexes and in the adult female, the upper parts are "fuscous-black" to "clove brown" in fall birds, somewhat paler in spring; the tail bands are narrow and broken, or restricted to mere spots; the under parts are heavily marked with broad streaks of "clove brown" or "bone brown", the dark colors predominating.

In the adult male the upper parts are "dark plumbeous", lightest on the rump and tail coverts, deepening to "blackish plumbeous" on the upper back and to nearly black on the nape; the tail is black, with white tip spots and three or four interrupted bars or spots of "dark plumbeous"; the chin and throat are white, with narrow black streaks; the remaining under parts are strongly washed with "cinnamon-buff" and broadly streaked with black; the black predominates on the belly and flanks. Mrs. Fannie H. Eckstorm (1902) has given us a fine description, in more detail, of a very dark specimen, an extreme melano.

Behavior.—The food, manner of hunting, and other habits of the black pigeon hawk are similar to those of its eastern relative. It is the same bold dashing little falcon. Mr. Rathbun writes to me: "A friend of ours was hunting jacksnipe on marshy pastureland quite some distance north of here. The section was open, although a long distance away was a standing tree or two. The snipe came darting past my friend just within long gunshot. He swung on one, and when the gun cracked the bird started falling in a diving, fluttering flight, appearing to have a broken wing. But only part of its descent had taken place when 'from nowhere' flashed a small, dark hawk, its flight so swift that it appeared only as a 'blurr in the air'. The hawk struck the snipe squarely in mid-air, then quickly carried it away. The whole occurrence took place so quickly that, although a shot was fired in turn at the departing hawk, it had no effect, as it was practically out of range when the shot was fired, for my informant was taken completely by surprise at what had occurred."

Since the above was written, I have been interested in reading the following suggestion by Harry S. Swarth (1935) as to the validity of this dark form as a geographical race:

> "*Suckleyi* was described, and has been regarded, as an extremely satisfying example of the darkening effect of the humid coastal environment of the northwest, as another 'saturated' local race. However, breeding birds are unknown

from any point whatsoever, and, so far as I am aware, no specimens of *suckleyi* have been collected on the coast north of Vancouver Island. On the other hand, migrants have been collected east of the Coast Range the entire length of British Columbia. South-bound migrants collected by myself near Atlin, where the form is not uncommon, were taken such a short distance south of the Yukon Territory boundary as to make it obvious that *suckleyi* must breed in at least the upper portion of the Yukon drainage. In the Atlin region, *columbarius* and *suckleyi* occur in about equal numbers. Indeed, so far as I know, wherever *suckleyi* has been collected typical *columbarius* has been found as well. Do not these facts point toward the probability of the existence of two color phases of *Falco columbarius* in the northwest rather than of two geographic races? Is there, indeed, anything corroborative of geographic segregation of these forms?"

Hamilton M. Laing (1935) evidently does not agree with the above theory, and produces some evidence to indicate that the black pigeon hawk is a good race and occupies a fairly definite breeding range in the heavily forested coastal region of British Columbia and the interior of Vancouver Island.

FALCO COLUMBARIUS RICHARDSONI Ridgway

RICHARDSON'S PIGEON HAWK

HABITS

This beautiful little falcon, the palest of the American merlins, is a bird of the Great Plains, breeding mainly in southern Alberta and Saskatchewan, in Montana, and in northwestern North Dakota. Its summer home is on the wide rolling plains and prairies, where they are dotted with small groves of poplars, aspens, cottonwoods, and other deciduous trees. Prof. William Rowan writes to me that in Alberta this falcon "breeds quite regularly, though not abundantly, in the Edmonton district, in the Cooking Lake and the Sullivan Lake districts, also on the Red Deer." He also thinks that it "breeds farther north than is indicated in the Check-List, at least up to Athabaska and possibly to the northern limit of the Canadian Zone."

This falcon, when first discovered by Richardson, on the plains of the Saskatchewan, was supposed to be identical with the European merlin, which it somewhat resembles. Richardson's specimen, figured in Fauna Boreali-Americana, plate 25, under the name *Falco aesalon* was taken near Carlton House on May 14, 1827. Its distinctness from that species was not discovered for many years, when Ridgway (1870) described it as a full species and named it for its discoverer. Mr. Ridgway (Baird, Brewer, and Ridgway, 1905) later decided to regard it as a subspecies of *columbarius*, and it has so stood in the last two editions of our Check-List.

Spring.—T. E. Randall writes to me that Richardson's merlin, as the bird was called for many years, is the first migrant to appear in the spring in the vicinity of Castor, Alberta. His earliest record is February 22, 1924, a male bird. "The bird is quite common by April 1;

and the birds have paired and chosen nesting sites by the middle of that month."

Nesting.—Mr. Randall says (MS.) of its nesting habits: "An old crow's nest is invariably used, generally one that is built in the fork of a poplar, 15 to 18 feet from the ground. The nest is always relined with dry inner bark of poplar. Laying commences about the first of May, and four is the usual clutch, but I have twice found five eggs. If the first clutch is taken, the birds will often take possession of another nest, at no great distance from the first, and lay a second clutch of eggs, but I find that the second clutches number only three eggs. If the nest tree is climbed before an egg is laid, the birds always desert the nest; on one occasion of which I have record the birds returned to their first choice on being disturbed at the second nest. This year, 1924, for the first time in my experience, a pair of merlins nested in a nest that was used by merlins in 1923; after the eggs were taken, a pair of Swainson hawks took possession of the nest and reared their young."

W. J. Brown spent the spring and summer of 1904 at Lethbridge, Alberta, and has sent me his notes on eight nests of this falcon that he found from May 7 to June 5. Five of these were in old magpies' nests, one in an old nest of ferruginous roughleg, and two in old crows' nests. "Two pairs of these birds were nesting in holes in cutbanks, but their nests could not be reached."

J. E. Houseman (1894) found a nest of Richardson's pigeon hawk near Calgary, Alberta, in a cavity in the top of a black poplar, where the trunk had been broken off. On May 5 it held only one egg, and a week later there were four perfectly fresh eggs, indicating that an egg is laid every other day. "The cavity these eggs were in was about eight inches across, one and one half feet deep, and 22 feet from the ground." G. F. Dippie (1895) found two more nests, the following year, in the same general region, in hollows in large black poplars.

Frank L. Farley sends me the following notes: "I have found five or six nests of this little hawk, and all have been within a half mile of a lake or river, sometimes within a few hundred feet. Two of these were in spruce trees, in dense spruce woods along the Saskatchewan River, from 30 to 60 feet from the ground. Two others were in poplars in small groves on the prairie, averaging 25 feet from the ground. Another was in an old covered magpie's nest, 15 feet up in a willow clump. All the nests were loosely constructed and looked as if they had been used previously. All the nests were lightly lined with pieces of the inner lining of poplar bark. Both old birds are very noisy, when one approaches the nest, uttering a shrill, scolding note; this action on the part of the birds often leads to the discovery of the nesting tree."

Eggs.—Richardson's pigeon hawk lays from three to six eggs, usually four or five. Mr. Randall's notes indicate that four is the usual number, and Mr. Rowan evidently agrees with him; but Mr. Brown took seven sets of five, one of six, and none of four. Most of the eggs are indistinguishable from eggs of the eastern pigeon hawk, but some are more lightly spotted, showing more ground color. Mr. Rowan thinks that they are more like eggs of the hobby falcon (*Falco subbuteo*) than like those of the merlin. The measurements of 48 eggs average 39.8 by 31.2 millimeters; the eggs showing the four extremes measure **43.3** by 32, 42.7 by **32.5**, **37** by 30.5, and 39.1 by **30** millimeters.

Plumages.—The sequence of molts and plumages is apparently the same as other pigeon hawks, but this race is easily distinguishable in any plumage by its much paler coloration. The sexes are alike in the immature plumage of the first year. This is similar to the corresponding plumage of *columbarius* but much paler; the upper parts are "hair brown" to "light drab", with "cinnamon" edgings when fresh; the under parts are paler and less heavily streaked than in eastern birds.

In the adult male the upper parts are pale, bluish gray, or "cinereous", slightly darker on the upper back and crown, with narrow, black shaft-streaks; the tail is "gull gray", or paler, tipped with white, with a broad subterminal band and three interrupted bars of black, the gray bands as wide as, or wider than, the black; the under parts are white, or creamy white, deepening to "cinnamon-buff" on the tibiae and paling to pure white on the chin and throat; the throat and tibiae are lightly, or not at all, streaked with black; the body below is streaked with "buffy brown" or "snuff brown", with darker shaft-streaks; the white bars on the remiges are wider than the dark spaces.

The adult female is similar to the male but has a distinct brownish cast on the upper parts, much like the immature birds; and there are usually spots of "light ochraceous-salmon" on the outer webs of the wing quills.

Females and immatures are much like the corresponding plumages of *bendirei*, but paler.

Behavior.—We found this little falcon to be quite rare in southwestern Saskatchewan. During two seasons there I succeeded in collecting only one specimen and found no nest; my companions collected another, and we saw two or three other birds supposed to be this falcon. My bird was shy and was secured only by exercising a little strategy. As we were driving along a prairie road we saw a small hawk sitting on a fence post by the roadside; as we approached he kept flying along ahead of us, alighting on the fence posts at frequent intervals, but never allowing us to come within gunshot range.

So I stopped the wagon, alighted from it, made a long detour to a point far ahead of the hawk, and hid behind a bank. As my companion came along, the hawk behaved as he had before and finally flew past me near enough for me to secure him.

I cannot find anything to indicate that the food, voice, or other habits of this bird differ materially from those of other pigeon hawks.

Fall.—Richardson's pigeon hawk migrates southward in fall, mainly east of the Rocky Mountains, through Colorado, New Mexico, and western Texas. Mr. Randall says that it is one of the last of the migrants to leave Alberta; his latest record is December 5, 1922.

FALCO COLUMBARIUS BENDIREI Swann

WESTERN PIGEON HAWK

HABITS

This supposed northwestern race of the pigeon hawk is not a very well marked subspecies. It seems to me to be only an intermediate between two of the other races and therefore hardly worthy of recognition in nomenclature. It is said to be slightly paler above than *columbarius*, which may be due to interbreeding with *richardsoni*. I am inclined to agree with Harry S. Swarth (1935), who says: "I have examined series of Pigeon Hawks wherever opportunity has offered without being able to substantiate the existence of a western race, *bendirei*. * * * I am unable to distinguish between eastern and western examples of *Falco columbarius* in normal plumage, but it may be desirable to recognize a northwestern subspecies on the same grounds as *Buteo borealis calurus*, that is, on the basis of a dimorphism that is prevalent over part of the species' range. For this subspecies the name *Falco columbarius suckleyi* is available, of course; *bendirei* should be ruled out in any event."

What little we have available on the habits of pigeon hawks, in the regions supposed to be occupied by this race, indicates no variation from the habits of the species elsewhere. M. P. Skinner tells me that he has seen them in Yellowstone National Park, some of them "quite dark", during every month from April to October; his earliest date is April 15, and his latest October 10. He says that "these hawks are like the sharpshins in preferring the edges of the forests and the open country, dotted with groves, to the heavy forests."

Nesting.—H. R. Taylor (1888) writes of a nest, containing five eggs, that he found on April 6, 1888: "It was on a steep mountain side, in Santa Clara Co., Cal., on a ledge of a precipitous bluff about thirty-five feet high." The nest "was composed simply of pieces of friable rock."

Behavior.—Mr. Skinner says, in his notes: "Although most of the pigeon hawks' prey are small birds flushed and chased down, they are versatile hunters. I have seen them circle over and hunt a meadow as a red-tailed hawk would; and I have seen one hover in air for some time like a sparrow hawk and then shoot straight down to the ground at high speed."

FALCO AESALON AESALON Tunstall

MERLIN

CONTRIBUTED BY FRANCIS CHARLES ROBERT JOURDAIN

The claim of the merlin to a place in the American list rests, according to the fourth edition of the A. O. U. Check-List, on the fact that it is "accidental in Greenland." The latest and best authority on Greenland birds is the monumental work "Danmarks Fugle", initiated by the late E. Lehn Schiøler, of which the third volume, dealing with the Raptores, was completed with the help of R. Hørring, H. Scheel, and Å. Vedel Tåning. Here two races of the merlin are recognized from western Europe, the typical race (which most European ornithologists regard merely as a form of the pigeon hawk, *F. columbarius*, and which, according to the A. O. U. Check-List, should be called *F. aesalon aesalon* Tunstall) and the Icelandic race (*F. aesalon subaesalon* Brehm). As the nearest point of the Iceland coast is only about 300 miles distance from east Greenland, while the Shetlands are at least 1,300 miles away, it would seem probable that stragglers to the Greenland coast would belong to the Iceland form, if recognizable. This is not the place for an analysis of the distinguishing points of the two races, but, on the measurements given in "Danmarks Fugle", the Iceland bird is the larger, the wing of Icelandic males measuring 209.7 mm (average), females 228.9 mm, while Scandinavian birds average 197.8 mm (males) and 213.6 mm (females), and Faeroe birds are intermediate, the males averaging 200 mm and the females 221.7 mm. According to Kleinschmidt, who pointed out the difference between the Icelandic and European forms and proposed the name *Falco alfred-edmundi* for the Iceland bird in 1917, there is also a difference in color, the Icelandic bird being darker. In Schiøler's work details are given of about four American occurrences: One at sea, south of Greenland, in May 1867; another at Cape Farewell on May 3, 1875; one near Christianhaab on July 1, 1883 (?); and one for Angmagsalik, July 3, 1914; with another possible occurrence in 1908. The early records were ascribed to the Scandinavian form, but the distinctness of the Iceland race was not then appreciated; the Angmagsalik bird must be definitely classed as Icelandic (if recognized), as its wing (female, juvenal) measures 228 mm and the culmen 15 mm.

In the following notes no attempt has been made to separate those referring to the Icelandic form from those applicable to the typical race.

HABITS

In Iceland the merlin is a summer resident, arriving about the end of March or the beginning of April, but in the Faeroes and the British Isles it is mainly a resident, although many, probably including most of the birds of the year, move southward in autumn and may be met with in districts where the species is never known to breed.

It is a bold and dashing little falcon and has no hesitation in attacking birds larger than itself, such as the golden plover and lapwing, but its normal prey consists of small birds, such as the meadow pipit (*Anthus pratensis*) and the other small passerine birds that are to be found on the outskirts of the moorlands. In Iceland there is little cultivation, and here the merlin is by far the commonest raptorial bird, though nowhere numerous. In this treeless land of lava fields and moors one comes occasionally on a pair that has selected a breeding site, generally on some rocky outcrop or cliff, but at times also among the scanty heather on the ground. In the Shetlands and Orkneys it is also the commonest of the Accipiters and may be met with almost anywhere, not only on the tops of the hills, but also, as Saxby (1874) has well described, in the marshes and on the cliffs or by the shore, while it includes in its hunting grounds the roofs and chimneys of the villages and may dart down upon a sparrow or a twite even at the very door of a house.

Farther south, on the mainland of Scotland and the moors of northern England, its home during the summer months is on the hills, where it may be seen perched on a rock or swiftly flying over the rough pastures and heaths, beating the countryside with untiring zeal until some luckless small bird is flushed and flown down. Here its nest is usually to be found in or near the same spot year after year. Seebohm (1883) gives details of two sites on the Yorkshire moors for five years. During this period, on several occasions, both male and female were shot by keepers at the nest, and the young or eggs destroyed. Yet the next year, or sometimes after an interval of a year, another pair of birds appeared and recolonized the old site. To anyone living on a grouse moor in northern England, it seems almost incredible that the stock can be kept up, for the breeding places are known by tradition to the keepers and it is only occasionally that a pair manages to bring off a brood from some remote part of the moor. Where the birds came from to replenish the vacant sites was long a mystery, for though the merlin does little real harm on a grouse moor, no keeper will ever allow this beautiful little falcon to hatch off, if he can possibly prevent it with the help of a trap or a cartridge or two. Fortunately for ornithology, there are, however, large tracts of hills, covered chiefly with rough pasture and a little heather and bracken, which are practically valueless as far as grouse are concerned and so do not come under the keeper's jurisdiction. Often these hills are on the edge of the industrial districts of Yorkshire and Lancashire, and the numerous tall factory chimneys, which disfigure the valleys, make the place look most unlikely as a breeding haunt for a falcon, yet it is here that the merlin has found sanctuary, and it is from these unpromising-looking surroundings that the annual output of young birds moves south every year to return to the historic sites on the grouse moors, where so many of their relatives have died. There is no part of the British Isles where merlins may be found nesting in fair numbers in such restricted areas, as this "no man's land."

South of the Trent the merlin is only an autumn and winter visitor to the midland and southern counties, except among the hills of Wales and on Exmoor. Here a certain degree of variation in the breeding site begins to be apparent. In the northern part of its breeding range there are no trees, and it must breed among the heather or on the rocks. There are a few cases on record in Scotland and northern England where it has bred in an old nest of a hooded or carrion crow, but in Wales this habit becomes quite common, and on Exmoor the pair or two that still breed prefer to use an old nest in a tree or straggling hedge. Another site adopted by Welsh merlins is among sand dunes overgrown with marram grass. Here in a little cup scratched out in the sand and lined with grass, the merlin has found a new type of nesting place.

Courtship.—Little is on record on the coursthip of the merlin, but like so many other Accipiters, both male and female describe aerial evolutions high in the air over the nesting site at the beginning of the breeding season and especially on warm sunny days. At other times the merlin does not fly high. William Rowan (1921–22), who has described the breeding of the merlin on the Yorkshire moors very fully, did not observe any aerial courtship but suggests that the feeding of the female by the male at the nest site may be part of the ceremony and is frequently followed by sexual union.

Nest.—In the foregoing remarks something has already been said as to the different types of sites adopted by the merlin in different surroundings. Little actual nest is made. When in heather or on rocks it is little more than a hollow in the ground with a few heather twigs artlessly arranged, but grasses may be pressed down if already present. When an old nest of some other species, crow or raven, is used, practically nothing is added to it. On the sand dunes the marram grass is formed into quite a passable nest. Rowan (1921–22) noted that, during the early stages of incubation, the bird would break off twigs from heather within reach and add them to the nest. He also noted bits of bracken in a nest when a patch was within easy reach.

A very extraordinary site is recorded by Nordling from Finland, in a weatherworn and old hole of a woodpecker in a tree. In the wooded parts of Scandinavia and Finland, an old nest in a birch or pine is frequently used, although beyond the tree limit, only cliff and ground sites are available. It seems to be an almost invariable rule that a nest on the ground should command a good view of the adjacent country.

Eggs.—The commonest number of eggs in England is four, and five are quite exceptional. Farther north the proportion of fives seems to increase, and in the Orkneys and Iceland they are common enough. The six set has occurred in Scotland at least nine or ten times and probably oftener, while seven occur in Sweden in lemming years and have also been recorded from Finland. Six have also been recorded from Iceland. Second layings may consist of only three eggs, but E. R. Paton (1917) says that it is also found in first layings at times, and J. A. W. Bond confirms this.

In color they show less variation than the kestrel's eggs, and they are sometimes rather elongated in shape, but normally almost oval, the creamy ground being often quite concealed by red-brown stippling and spots. It is rare to find a really richly and boldly marked clutch, and the most remarkable varieties are those in which most of the coloring matter is absent and a good deal of the creamy ground is visible. One remarkable set has three eggs almost white, while the fourth is clouded with red-brown. Other varieties show patches of violet shell marks, while some sets have a very attractive violet bloom, and others are of a pale yellowish type, approaching that of the hobby (*F. subbuteo*). All the eggs are rather dull, and those from the moors near industrial centers become much contaminated by soot in the air.

Measurements of 100 British eggs average 39.95 by 31.27 millimeters; the eggs showing the four extremes measure **42.4** by 32, 41.4 by **33.8, 37** by 29.1, and 40.3 by **29** millimeters. Fourteen Icelandic eggs average 40.9 by 31.9 millimeters; the eggs showing the four extremes measure **42.3** by 32.8, 41 by **33.2,** and **38.9** by **30.2** millimeters.

Young.—The eggs are laid at 48-hour intervals, i. e., every second day, and Paton (1917) states that in a clutch of three it begins with the third egg; other observers are of the opinion also that it begins on the completion of the set. Both sexes take a share in incubation, but there seems to be a consensus of opinion that the female takes the greater share of the work. Rowan (1921–22), however, states that in one case where he watched at night the male was incubating all the time. During brooding the hunting is done by the male, the hen generally keeping to the neighborhood of the nest, while she preens and sleeps during her mate's spell of brooding.

The incubation period is estimated by Rosenius at 25 days; Edmondson states that it is not less than 26 days, while Rowan says that three eggs hatched on the twenty-ninth day, and Paton gives 30 days (minimum 29.) On the whole I think about 29 days would be a fair average. In a case recorded by H. S. Gladstone (1910) hatching was spread over 3 days, so probably in this case incubation began before the clutch was complete.

The young are fed by the female, who leaves her station and takes the prey from the male, not at the nest, but generally at or near one of the perching places in the neighborhood. The young remain in the nest for 25 to 26 or 27 days but stay in the vicinity for some time longer. Only one brood is reared in the season.

Plumages.—The plumages are fully described in Witherby's Handbook (1924, vol. 2, pp. 116–118) and need not be repeated here at length. The male is readily recognizable by his slaty-blue upper parts, while the tail has a conspicuous broad black band; the hen is not unlike a hen kestrel but lacks the reddish-brown color, which is replaced by brown in which the red is lacking. The flight, however, is quite different—low, eager, and dashing.

Food.—The food of the merlin consists almost entirely of small passerine birds, very largely meadow pipits, but also occasionally skylarks, twites, linnets, yellow buntings, ring ouzels, and song thrushes, while over 20 other species have been recorded from time to time. Besides these small birds up to the size of the mistle thrush and starling, downy young of grouse are known to be taken at times, but only in the very early stages, and larger birds, such as the smaller waders, and even the golden plover, lapwing, rock dove, and lesser tern have been recorded as taken. Mammals (voles and one record of rabbit), insects in small numbers, and lizards complete the bill of fare.

Behavior.—Although so small a bird, the merlin is extremely bold. Dr. H. L. Saxby (1874) says of it: "I have repeatedly seen it, with rapid swoops and loud menacing cries, send a cat sneaking home from under a hedge, and I once saw it openly attack a full grown Hooded Crow; only desisting when, attracted by the outcry, two old ones came hurriedly to the rescue. * * * More than once I have known it to seize a newly shot golden plover as it fell, and although unable to lift it many inches from the ground, and constantly compelled to drop it, make such good use of its opportunity as to be far beyond reach with it by the time the shouting and gesticulating shooter, having reloaded, was at liberty to follow in pursuit." J. G. Millais (1892) also once saw a merlin dash at a black cock and send it sprawling. Saxby (1874) also says that it is very easily tamed and becomes a most docile and intelligent pet. One that was allowed full liberty could be instantly recalled by waving about in the sunlight a tin basin in which its food was usually kept.

Voice.—This has been very well and carefully described by Rowan (1921–22). First of all there is the alarm note, a rapidly repeated *kek-kek-kek,* not unlike that of the kestrel. In the cases that came under Rowan's observation, the note of the cock was higher pitched than that of the hen, and readily recognizable. The feeding note of the male closely resembles the alarm note but is repeated only half a dozen times and more rapidly than when alarmed. The hen responds to this with her feeding note, a characteristic, long-drawn and oft-repeated *eep-eep-eep,* which she keeps up for some minutes continuously. Rowan also records a soft *tick,* uttered when alighting at the nest, by both sexes. The hunger call of the young somewhat resembles the food cry of the hen, but it is not so loud and is repeated more quickly.

Enemies.—The one real enemy of the merlin is the keeper, but with little reason, for the grouse live on good terms with it, and it is only for a very brief period in the season that the chicks are ever taken.

DISTRIBUTION

Breeding range.—Falco aesalon subaesalon breeds in Iceland, an intermediate form in the Faeroes, and the typical race in the British Isles (Scotland and its islands, northern and southwestern England, Wales, and Ireland), Norway, Sweden, Finland, northern and middle Russia, and western Siberia. Other races breed in southeastern Russia (*F. a. pallidus*), and in Asia, from Turkestan to Japan (*F. a. insignis*).

Winter range.—Faeroes and British Isles, migrating from northern Europe through middle Europe to the Mediterranean region, wintering commonly in northwestern Africa (*F. a. aesalon*) and in Egypt (*F. a. insignis*). Asiatic birds winter south to Turkestan and northwestern India.

Migration.—The Iceland bird has recently been proved to visit the British Isles, a banded bird having been obtained in Kings County, Ireland. The four, or perhaps five, American records have already been mentioned. A juvenile bird has also been recorded as far south in Africa as Natal (Ibis, 1920, p. 508). In the Arctic region it has been recorded as a casual off Bear Island, and it is a common passage migrant in Novaya Zemlya, where it may possibly breed.

Egg dates.—Of 34 dates from the British Isles, ten fall between May 9 and 15, seven between May 16 and 22, and eleven between May 23 and 29; of June dates (first to twenty-first) there are six, but one on June 6 was much incubated, and one on the twelfth a second laying, while that on the twenty-first was probably also a second laying. Four Iceland dates fall between May 20 and June 12, while seven dates from Finland fall between May 30 and June 25.

FALCO FUSCO-COERULESCENS SEPTENTRIONALIS Todd

APLOMADO FALCON

HABITS

This handsome little falcon, with its two closely allied races, is widely distributed throughout nearly all of South and Central America. Our northern race is found in Mexico, and probably in Yucatan and Guatemala; its range northward barely crosses our southwestern border in southern Texas, New Mexico, and Arizona. Its haunts are the open plains, with growths of mesquite, yucca, and cactus.

Nesting.—Dr. J. C. Merrill (1878) found two nests near Brownsville, Tex. The nest found on June 16, 1877, was "placed in the top of a low Spanish bayonet growing in Palo Alto prairie"; it "was a slightly depressed platform of twigs, with a little grass for lining. The eggs, three in number, were rotten, though containing well-developed embryoes." The second nest, found on May 7, 1878, was similar in situation and construction, "except that the yucca was higher, the top being about twelve feet from the ground. The eggs were three in number, all well advanced but one, with a dead embryo."

Major Bendire (1892) writes that Lt. Harry C. Benson found this falcon "fairly common" in the vicinity of Fort Huachuca, Arizona, and says: "Five nests were found by the lieutenant during the spring of 1887, all of them placed in low mesquite trees from 7 to 15 feet from the ground. These nests were apparently old ones of the White-necked Raven (*Corvus cryptoleucus*), and used without any repairs being made to them. A nest found on April 25, 1887, contained three young birds, which were taken by him and raised, becoming quite tame; one found on April 28 contained three fresh eggs; another found on May 5 likewise contained three eggs, two with large embryos, the third addled. A fourth and fifth nest, both found on May 14, contained each two fresh eggs, possibly a second laying of some of the birds previously despoiled."

I spent considerable time at these two localities, both in Texas and in Arizona, but failed even to see one of the birds. Three sets of eggs in the Thayer collection and two sets in the author's collection, all from Frank B. Armstrong, were taken near Brownsville, Tex., from nests in Spanish bayonets, or daggers, at heights varying from 10 to 14 feet from the ground; this species of yucca seems to furnish the favorite nesting site in that locality.

Eggs.—Three eggs seems to constitute the usual set for the Aplomado falcon, though sets of four seem to be fairly common in Texas. The eggs vary in shape from ovate to nearly oval. The shell is smooth and finely granulated. The ground color is white, creamy white, or pinkish white. This is usually nearly, or quite, covered with small spots or minute dots of "russet", "cinnamon-rufous", or other bright browns. Some eggs are thickly sprinkled with reddish-brown spots and blotches of various sizes; and others are sparsely spotted with paler browns, showing the ground color. To my mind they look like small eggs of the prairie falcon, showing some similar variations. The measurements of 56 eggs average 44.5 by 34.5 millimeters; the eggs showing the four extremes measure **48** by 34.7, 47.5 by **36.2**, **40** by 32.9, and 44.3 by **31.1** millimeters.

Plumages.—I have never seen the downy young or any nestlings of this falcon. In the immature plumage of the first year, the color *pattern* is similar to that of the adult, but the *colors* are quite different. The upper parts are "bone brown" to "sepia", with narrow buff edgings; the tail has eight or nine narrow, broken bars, or spots of dull white; the dark areas on the under parts are "bone brown" when fresh, fading later to "warm sepia" or "bister"; the anterior under parts are "cream-buff" to "cinnamon-buff" when fresh, heavily streaked on the breast with "bone brown", but the chin and throat are unmarked; the belly, between the dark areas, and the tibiae are "pinkish cinnamon" to "cinnamon"; these light-colored areas fade out to pale buff or nearly white, and the narrow edgings on the mantle wear away; the lining of the wings is black.

There is apparently an intermediate, perhaps a second-year, plumage in which the upper parts are more plumbeous than in the young bird but browner than in the adult; the feathers of the dark areas below are no longer immaculate, as in the young bird, but have small white spots along their edges; the tail is as in the young bird, the lining of the wings is still black, and the breast is still heavily streaked with black. This may be merely a transition plumage.

In the fully adult plumage, the upper parts are "dark plumbeous" to "plumbeous", darkest on the crown; the upper tail coverts are tipped with white; the tail is dark slate, broadly tipped white, and with five to seven white bands; the chin is white, shading to "cinnamon-buff" on the breast and immaculate; the lower breast and flanks are black, the feathers narrowly tipped with white; and the lining of the wing is white, barred with dusky.

Food.—Bendire (1892) says that "their food consists of small reptiles, mice and other rodents, grasshoppers and insects of various kinds, and occasionally a bird." Mrs. Florence M. Bailey (1928) adds dragonflies and seeds to the list. Col. A. J. Grayson (Lawrence, 1874) has seen it hunting ground doves, quail, and other birds. Maj. Allan Brooks (1933) writes: "This graceful falcon is not much in evidence until a prairie fire is started on the wide coastal plain [near Brownsville, Tex.], when they quickly arrive, sweeping gracefully backwards and forwards in front of the advancing flames and deftly capturing the large green locusts that are driven to flight. These are eaten on the wing, the falcon rising in the air as it picks its prey to pieces, returning to the lower level to resume its hunting as each capture is disposed of."

Dr. John B. May (1935) says: "Manuscript notes in the Bureau of Biological Survey state that J. S. Ligon examined two stomachs which held a Lark Bunting and a Lark Sparrow respectively, and that R. T. Kellogg examined one which held two dragonflies, a cricket, a Horned Lark, and some seeds (possibly from the crop of the Lark)."

Behavior.—Colonel Grayson (Lawrence, 1874) writes:

> This handsome little hawk may be recognized when at some distance off, while upon the wing, by its lengthened and fan-like tail. I found it not uncommon in the vicinity of Mazatlan and San Blas, where I have shot and preserved specimens in the winter months, and with many opportunities of observing its habits. It seems to prefer a sparsely wooded country, where there are scattered trees and low bushes. In its habits I am reminded at times of the Sharp-shinned Hawk (*A. fuscus*) in its stealthy manner of hunting for its prey beneath the thick foliage of the woods, flying near the ground, or perching in secluded places, from whence it watched, cat-like, for quails, ground doves, etc. It, however, may be seen at other times, falcon-like, boldly pursuing its prey in the open country, and the smaller species of ducks, as well as pigeons, plovers and sandpipers, are attacked and captured on the wing by this swift flying little falcon. I am not aware that it breeds in this locality, not having seen one during the season of nidification.

Henry W. Henshaw (1875) says:

> In 1874, this hawk was seen, on four different occasions, at distant localities in Southeastern Arizona. It would thus appear to be not very rare in this section. All the individuals noticed were among the timber of the streams as they issued out on the plains; and in such localities it doubtless finds an abundance of small game, feathered and otherwise, which flock to the very limited supply of water. They did not appear very shy, and I had no difficulty in obtaining a shot in three instances, in two of which, however, the birds, though most grievously wounded, succeeded in flying so far that I was compelled to give them up. Their flight is light, powerful, and easy, and their whole organization classes them at once among the noble birds of prey.

Field marks.—There should be no difficulty in recognizing this beautiful little falcon at any reasonable distance in life. In addition to the falcon method of flight, its color pattern is very distinctive in any plumage; the blue-gray upper parts, the cinnamon breast and thighs, and the black flanks and belly of the adult are very conspicuous; the young bird has a similar pattern but is browner in the dark areas and is streaked on the breast.

DISTRIBUTION

Range.—South and Central America north to Arizona, New Mexico, and Texas. The range of the Aplomado falcon extends **north** to Arizona (Tucson and Tombstone); New Mexico (Engle, Apache, and Rincon); and Texas (Toyah and Fort Stockton). **East** to Texas (Fort Stockton, Pecos, and Brownsville); Tamaulipas (Matamoras, Quizaro, Altamira, and Tampico); Veracruz (Mirador); southern

Lesser Antilles (Trinidad); British Guiana (Mount Roraima and Takutu Mountains); Brazil (Mixiana Island, Pará, Itaraca Mountains, Marianna, and Rio Sapetiba); and Argentina (Buenos Aires, Cape San Antonio, Rio Colorado, Rio Negro, Chubut Territory, Puerto Deseado, and Tierra del Fuego). **South** to southern Argentina (Tierra del Fuego); and southern Chile (Isla la Mocha). **West** to Chile (Isla la Mocha, Nilahue, Marga-Marga Valley, Coquimbo, and Viluco); western Bolivia (Caiza and Lake Aullagas); Peru (Arequipa); Ecuador (Crater of Pichincha and Antisana); western Colombia (Cali); Guatemala (San Agustin); Oaxaca (Tehuantepec); Nayarit (San Blas); Sinaloa (Mazatlan); Chihuahua (Lake Palomas); and Arizona (Fort Huachuca and Tucson).

The range as above outlined is for the entire species, which has, however, been separated into two geographic races. The typical form, *Falco f. fusco-coerulescens*, is widely distributed in South America, ranging north probably to Panama. The northern form, *F. f. septentrionalis*, is found from (at least) Guatemala north through Mexico to the Southwestern United States. The exact limits of the respective ranges are imperfectly understood and some taxonomists recognize two additional races in South America.

While the species does not appear to be regularly migratory, the individuals found in summer in the northern parts of the range withdraw southward in winter. At this season it is not found north of Sinaloa (Mazatlan) and southern Tamaulipas (Altamira). Similarly, in southern Patagonia, there is a slight northward movement at the onset of the southern winter.

Egg dates.—Arizona: 4 records, April 28 to May 14.

Texas: 29 records, March 14 to May 26; 15 records, April 12 to 26, indicating the height of the season.

FALCO TINNUNCULUS TINNUNCULUS Linnaeus

KESTREL

Contributed by Francis Charles Robert Jourdain

According to the fourth edition of the A. O. U. Check-List (1931) the kestrel is accidental in Massachusetts (Nantasket Beach) and Greenland (Cape Farewell). As to the first record there is fortunately no doubt. Charles B. Cory (1888) writes that a female of this species was shot at Strawberry Hill, Nantasket Beach, Mass., on September 29, 1887, and after being seen in the flesh by Mr. Cory, passed into his collection. With regard to the occurrence at Cape Farewell, the evidence is less clear. There is no mention of the record in Hagerup's paper (1891) on the birds of Greenland. It is significant that Herluf Winge, who corrected several errors of identification in this work (see Auk, 1891, p. 319) and published an authoritative work on the birds of Greenland (1898), omits it from his list; and from a note on page 32, I infer that it was merely a sight record at some distance from the coast. Schiøler also ignores the record altogether and states that there are no occurrences for Greenland. The Massachusetts record, however, is sufficient to give this species a claim to figure on the American list. The Greenland record, if quoted, should be relegated to brackets.

HABITS

There is one habit of this pretty little hawk that renders its identification in the field a very easy matter, and that is its method of hunting. One rarely watches a kestrel for more than a minute or two without seeing it "heave to" with head to wind and remain stationary in the air, sometimes with rapidly quivering wing tips and tail fanned out, at other times almost motionless for a few seconds while its keen eye scans the ground below. Then perhaps it drops a few feet through space and renews its quest, or else moves off a little farther and repeats the maneuver. This habit, together with its general brown coloration, is enough to identify it with certainty in the British Isles. In the Mediterranean region another species of kestrel with very similar habits, but with brighter coloring and more sociable habits, might be mistaken for it, and the red-footed falcon (*Falco vespertinus*) has the same hovering habit, but both species are known in England only as rare stragglers, while the kestrel is mainly resident and widely distributed over the whole of the British Isles and the adjacent islands. There is a certain amount of migratory movement in the northern part, for, in the Shetland Isles, they disappear entirely during winter. This is probably due more to the absence of mice and insects than to the cold, though in the northern part of the European Continent the winter snows drive it south, as then it can subsist only on small birds. In the Orkneys there are more gardens and enclosed spaces, so that it can pick up a living, but in the northern parts of Scotland and Ireland there is a very decided southward movement, and one meets with birds evidently on passage in autumn traveling southward along the river valleys, in places where they are not usually to be seen.

The kestrel would be an exceedingly common bird in England were it not for the gamekeeper. As a matter of fact, it is not as a rule injurious to game. The great majority of kestrels never touch game at all, but, in districts where pheasants are reared under hens in coops in the open fields, a kestrel will occasionally come foraging for mice and, seeing the young pheasants in numbers with apparently no mother bird in charge, may pick up a chick and in certain cases will return again and again for such easy prey, unless shot.

As a rule no keeper troubles to ascertain whether a kestrel's intentions are honorable or the reverse. By law they are in many counties under protection, but no keeper ever troubles himself about such a trifle, and shoots down every kestrel on his ground. A very enlightening fact that came under my notice was the effect of the great war of 1914–18 on the kestrel. In the second and third years of the war the number of men employed in game preservation was very greatly reduced; in fact all the able-bodied younger men were at the front. The increase in the breeding stock of kestrels in the home counties and the midlands was extraordinary. Where we had been accustomed to find one or two pairs scattered over a wide area, they were, in the third year of the war, present in dozens. Even the territorial system seemed to break down. Instead of each pair having a wide range of country to itself, I have seen two pairs breeding in hedgerow elms within 20 yards of one another, while a third was only 200 yards distant. This was in Berkshire; but after the war this species rapidly reverted to its former status, though there is now less ground preserved for game than was the case in pre-war times, and in consequence the kestrel finds a secure breeding place in the unpreserved districts.

Courtship.—The courtship of the falcons is simple in character and consists chiefly in aerial evolutions on the part of the male and the pursuit of the female. André Labitte (1932) describes it as observed by him on several occasions about the beginning of April. On bright sunny days, especially, the male may be seen pursuing the hen, with rapidly repeated cries of *ki-ki-ki-ki-ki.* At times the two birds seem to be playing together as they fly in the breeze, the male usually flying above the female and circling round her; then, as she perches on the branch of a tree, still bare of leaves, she seems to watch the evolutions. These end in a series of stoops, in which he brushes his companion with his wings.

Julian Huxley (1923) also records a similar scene witnessed by him in Berkshire: "The hen bird was sitting in a large bush. * * * A strong wind was blowing, and the cock again and again beat his way up against it, to turn when nearly at the house and bear down upon the bush in an extremity of speed. Just when it seemed inevitable that he would knock his mate off her perch and dash himself and her into the branches, he changed the angle of his wings to shoot vertically up the face of the bush; then turned and repeated the play. Sometimes he came so near to her that she would start back, flapping her wings, as if really fearing a collision. The wind was so strong—and blowing away from me—that I could not hear what cries may have accompanied the display."

Pairing sometimes takes place on a horizontal branch of a tree, or even in an old nest, but Labitte (1932) noticed that it was not necessarily that in which the eggs were subsequently laid.

Nesting.—Strictly speaking, the kestrel makes no nest, and the site chosen varies according to the district. Thus in the northern isles, where trees are absent or almost so, the eggs are generally laid in a recess or on a ledge in a cliff face, sometimes sheltered by ivy. An old nest of the hooded crow (*Corvus c. cornix*) among rocks is also frequently appropriated. In the wooded districts of the midlands and south, the most usual site is an old nest of a magpie (*Pica p. pica*) or carrion crow (*Corvus c. corone*), generally somewhat flattened out, while much less frequently old nests of rook (*C. frugilegus*), raven (*C. corax*), buzzard (*Buteo b. buteo*), heron (*Ardea cinerea*), sparrow hawk (*Accipiter n. nisus*), or even an ancient squirrel's "drey" may be occupied. Where there is a scarcity of breeding sites, a pair of kestrels will occasionally drive off a magpie from a new nest, after some days of fighting. One case of this kind came under my own notice in Derbyshire, and H. S. Davenport also describes a very similar incident. A regular pitched battle took place between a pair of kestrels and a pair of magpies, in which the latter were worsted and had to abandon their newly built home. In both these cases the magpies were evicted before eggs had been laid, but there is an even more surprising case on record (Phillips, 1908, p. 139) in which a nest of carrion crow, which contained young birds, was taken possession of by kestrels, which killed and ate the young crows. When examined, the nest contained not only a clutch of five kestrel's eggs, but many feathers from the crows.

Another site occasionally adopted by the kestrel is the broken top of some old elm or the jagged hole formed by the breaking away of a heavy branch. Old buildings, ruins, and church towers also provide many pairs with breeding places, and where the birds are not disturbed these are resorted to year after year. On the floor of a belfry in the tower of a church in East Anglia, I once saw a clutch of fresh eggs of this little hawk. Close by were several dirty, egg-shaped objects, which proved on examination to be infertile eggs, faded and dried up, from nests of previous years. Cases are also on record in which nesting boxes put up in trees have been appropriated; and likely holes, even in occupied houses and windmills, are sometimes taken possession of. Perhaps, however, the most surprising site is on the ground! In Wicken Fen, Cambridgeshire, nests have not infrequently been recorded among the coarse grass and sedge; and similar cases have occurred in other districts, such as Norfolk and the Outer Hebrides, but usually in places where trees are scarce or absent.

Eggs.—The number of eggs usually ranges from four to six, the last number being fairly common. Sets of seven are decidedly scarce, but I have known of 11 cases from various parts of the British Isles, while instances of eight are even rarer, and only five have come under my notice. There are cases on record in which two females have been found in attendance at one nest. Thus M. C. H. Bird once found nine eggs in a nest on the ground at Ruston, Norfolk, and this may have been a case of this kind. A more definite instance is that recorded by M. A. Mathew (1882), in which three kestrels, a male and two females, were seen at a nest containing six eggs, of two quite distinct types, four of one and two of the other. E. C. Stuart Baker also informed me that he saw 11 eggs taken from one nest in Finland, six of which were evidently the product of one hen and five of another.

When the first set of eggs has been taken, the female will lay again at least twice in the season, possibly oftener. The eggs are not laid on consecutive days, but at intervals of about 48 hours. Incubation generally begins as soon as the first egg is laid, and the eggs hatch out on alternate days, but apparently there are exceptions to this rule, as some sets show no differences in state of incubation. The period is estimated at about 28 days (A. G. Leigh), 27 to 28 days (W. Evans), and 29 to 32 (W. A. Shaw); both sexes take part in brooding, but the female takes the greater share. The male supplies the hen with food at the nest and takes her place when she leaves it. In the case of a pair that bred in captivity, the male relieved the female in turn, but some caution must be used in dealing with data of this kind, as the conditions are not natural.

The eggs are almost oval in shape and are very variable in color. The commonest type is that in which the ground is almost concealed by red-brown blotches and spots, varying in depth of color from light tawny-yellow to almost black. In some cases a great deal of the white ground is visible, and when the markings are rich bright red, or are concentrated in large blotches, they form very striking and effective contrasts. It is not rare to find single eggs in a set, white or nearly so, with only faint markings, but on one occasion I found a clutch of four infertile eggs without a trace of markings except a few nest stains. Bluish-gray or violet shell marks are also to be seen on some eggs, and in some cases the red-brown is replaced by dark chocolate. The average size of 100 British eggs, measured by the writer, is 39.73 by 31.77 millimeters; the eggs showing the four extremes measure **43.7** by 33.5, 41.6 by **34.2**, and **35.4** by **29.7** millimeters.

Young.—Only one brood is reared during the season. When the young are hatched, the male at first brings food which is given to the young by the female, who broods them; later both parents bring food to the nest, but according to Ludwig Schuster (1928), this does not take place till the young are two or three weeks old. Heinroth also noted, when rearing the young, that at the age of about three weeks they were capable of feeding themselves. Schuster also notes that feeding took place fairly regularly about once an hour from daybreak till late in the evening, and remarks that the hunting ground was not in the immediate neighborhood of the nest. The mean of a considerable number of observations on the fledging period shows that all estimates, with one or two exceptions, fall between 27 and 34 days, so that probably it varies usually from 30 to 32 days but is at times a little longer or shorter. Interesting observations on the development of a young kestrel in captivity have been made by A. Geoffrey Leigh (1911).

Plumages.—We do not propose to describe the plumage in detail, as full descriptions can be found in Witherby's Handbook (1924) and other works. The male in full plumage is recognizable in the field by his brown coloration and slate-gray head; tail and rump also are slate-gray, with a conspicuous black subterminal band on the tail. The back of the male is chestnut-brown, with blackish markings on the feathers, which distinguish it at once from the lesser kestrel. The hen lacks the slate-gray and has the mantle thickly barred with black, bill horn blue, dark at tip, and feet yellow.

Food.—To a very great extent the kestrel feeds on small mammals, especially rodents, and is therefore on the whole a most useful bird. It does not as a rule attack the larger mammals, such as the rabbit, though it has been known to kill a young one, and also a young leveret, and has been recorded as carrying off a weasel. The staple food, is, however, the long- and short-tailed field mouse, while bank-vole, house mouse, mole, shrew, rat, and exceptionally bats (noctule and pipistrel) are taken. In some districts where mice are scarce small birds are frequently captured, such as house sparrow, skylark, greenfinch, goldfinch, linnet, yellow bunting, pipits, hedge sparrow, starling, thrush, blackbird, fieldfare, lesser redpoll, and, surprising to say, swift. Though as a rule confining its attacks to small birds, there are cases on record of attacking sandpiper, wounded redshank, young lapwing and snipe; and it has been seen devouring wood pigeon and hooded crow, though it is very doubtful whether it is capable of killing the latter. It is generally harmless to game, but single birds may develop the habit of taking very young pheasants, grouse, and partridges. Other animals recorded as food are frogs, lizards, adder, slow-worm, beetles (*Geotrupes*, *Melolontha*, etc.), Orthoptera, caterpillars, and earthworms.

Behavior.—This species hunts openly, skimming over the countryside fairly high in air and hovering over some spot in a meadow, where he can perhaps detect a mouse running about in the grass. A suspicious movement below induces a drop to closer quarters and then a swift descent, which may or may not be successful. If the latter, up he goes again and resumes his beat until at last his stoop secures a victim. When after a bird, he flies it down, and I have seen one in pursuit of sparrows come swiftly around the corner of a barn into a crowd of noisy, quarreling sparrows and at once produce a headlong flight in all directions and a resultant silence. This open chase is quite unlike that of the European sparrow hawk, which flies low, only rising to top a hedge, and seeks to take its prey on the ground or perched on a bush before it has time to drop into safety. As a rule birds show far less fear of the kestrel than of the other hawks. In one remarkable case, I found a pair breeding in a rook's nest in the middle of a crowded rookery. In the same tree were five rooks' nests with young nearly fledged, a nest of wood pigeons with two eggs and, lower down, empty nests of sparrows and greenfinches, as well as an old blackbird's nest. A week or two later the rooks had flown, but the greenfinch and sparrow nests contained eggs.

Enemies.—Besides the gamekeeper, who is the only serious enemy the kestrel has, there are occasional cases where he comes to grief when he comes to grips with both raven and peregrine falcon. The latter will at times kill and eat the kestrel, and I know of one case in which a kestrel was killed and practically decapitated by a blow from a raven in midair. Hooded crows are also destructive to the eggs on the cliffs of the Irish coasts, and R. J. Ussher (Ussher and Warren, 1900) says that he has seen it hunted perseveringly by rooks.

Voice.—The usual note of the kestrel is a clear, ringing *kee, kee, kee*, or, as Naumann writes it, *klih, kli, kli.* The latter naturalist also records a soft *kiddrik, kiddrik.*

Fall.—Although, as stated above, the kestrel is, partially at any rate, resident in the British Isles, there is no doubt that immigration takes place during autumn, when birds from Scandinavia, Finland, and eastern Europe are moving southward and southwestward. It is, of course, difficult to prove this (except by banding), but the fact that it occurs fairly commonly at the light stations off the east coast is conclusive. C. B. Ticehurst (1932) states that eight were brought in alive to him on September 4, 1913, which had been captured on fishing boats at sea off Lowestoft, Suffolk, and on the same day he counted six on the wing at once on the Lowestoft "deries." Whether, as Menteith Ogilvie (1920) supposed, the birds that breed in East Anglia almost all migrate south and return about mid-March is very doubtful, and Ticehurst (1932) was quite unable to confirm the statement. On parts of the European Continent, where the winter is more severe than in the British Isles, the kestrel is necessarily a migrant, but even in the coldest parts of Germany, in the towns, some birds manage to pick up a living of sparrows and other prey, even when the country is deep in snow and deserted. Although chiefly a diurnal migrant, one was noted by Eagle Clarke at the Kentish Knock light in September.

DISTRIBUTION

Range.—Extends over the Palearctic, Ethiopian, and a great part of the Oriental regions; about nine races recognized.

Breeding range.—The typical race (*Falco tinnunculus tinnunculus*) breeds throughout Europe, north to latitude 70° in Norway and latitude 61° in Finland, also in the British Isles, and in the islands of the Mediterranean. In Africa its breeding range extends from Morocco eastward north of the Sahara, but in Egypt, the Canaries, and Cape Verdes it is replaced by other forms; also in tropical and southern Africa. In Asia its breeding range extends through north and central Asia across the continent to the Pacific, but in Japan, parts of the Chinese Empire, and the Himalayas it is replaced by other races.

Winter range.—Extends to tropical west Africa (Togoland and Haussaland) and to India and China.

Casual records.—Besides the record from Nantasket Beach, Mass., it has also been recorded from Iceland on at least one occasion, in October 1903 (skin in Reykjavik Museum, Hantzsch, 1905); in the Faeroes it was twice obtained by Müller (Feilden, 1872).

Egg dates.—For the British Isles most dates fall between April 16 and May 31, but second layings may be found throughout June. The earliest date of which I have any note is April 4, 1929, when a clutch of five eggs was found in County Tyrone, Ireland, and recorded by C. V. Stoney. A nest from Hants in the British Museum is also said to have been taken on April 4, 1862.

April 16–30 (9 dates); May 1–15 (17 dates); May 16–25 (13 dates); and May 26–31 (7 dates). In the Mediterranean region breeding is naturally earlier; thus, in south Spain, eggs are recorded from April 2 to May 9 (9 dates), and in Cyprus full sets may be found in the second week of April. In northern Europe, on the other hand, many birds have not laid up till June.

In middle Europe April records are scarce, and the vast majority of birds have not full sets till May.

FALCO SPARVERIUS SPARVERIUS Linnaeus

EASTERN SPARROW HAWK

Plates 18–21

HABITS

Contributed by Winsor Marrett Tyler

The eastern sparrow hawk, with its three local races, represents, in North America, a group of small falcons that in the Temperate and Tropical Zones is of nearly world-wide distribution. So closely do the members of this group resemble one another that over a very large part of the globe, wherever a traveler goes, he is sure to meet a bird that in plumage and behavior reminds him of one of the little hawks of his own country.

Our bird received its common name through the misconception of our English forefathers, who, primarily pioneers, failed to note its close relationship to their kestrel and misnamed it the sparrow hawk after the British bird of that name.

That our sparrow hawk has always been a favorite with American ornithologists is shown by the many appreciative, friendly comments that we meet as we pass through the literature. Thus Coues (1874) speaks of it as "the prettiest and jauntiest of our Hawks, and yet no prig", and Brewster (1925) calls it "most light-hearted and frolicsome."

Spring.—As the breeding season draws near, the sparrow hawk relaxes the habit of solitude to which it adheres, for the most part, during autumn and winter. It may be true, although it is not positively known, that the birds mate for life, as is believed to be the custom of some of the Raptores, but in any case, at the approach of spring—during April and May in the North Atlantic States—the birds are commonly seen in pairs, often on windy treetops, perched near together, either side by side or on adjacent branches. Here, not far from their prospective nest site, they remain quiet for long periods, with short flights together now and then, away and back again. The difference in size proclaims them, even at a long distance, to be male and female, and they display by their attention to each other, which strongly suggests affection, the connubial character of their association.

Courtship.—William Brewster (1925) describes thus the behavior of a pair of sparrow hawks, evidently on or near their breeding station on May 17, 1881:

> To-day I saw them sitting not far apart on the tops of neighboring dead balsams. Every now and then one, always the male, I thought, would mount high in air to fly very rapidly, in a wide circle over and around where the other was perched, bending the tips of his wings downward and quivering them incessantly, at the same time uttering a shrill, clamorous *kee-kee* cry, oft repeated. Sometimes both would start off together, to chase one another far and near, describing all manner of beautiful curves and occasionally sweeping down almost to the surface of the water. On realighting they invariably chose the very topmost twigs, often very slender ones, and settled on these with no less abruptness than precision, yet with admirable grace, scarce checking their speed until the perch was well-nigh reached and just then deftly folding their shapely wings.

Sherman C. Bishop (1925) had the opportunity for a period of two weeks to watch the mating activities of a pair of birds that had "established their hunting headquarters on the tops of some marble columns which are a few feet below and a hundred feet away from my office windows." He notes under April 14: "Preliminary to mating, the birds faced one another and slowly bobbed their heads and tails, the female keeping up a continuous low call", and under April 17: "Raining. Female called most of the afternoon. After mating, the male sometimes mounts high in the air and performs some remarkable evolutions—spirals, short dashes and a rapid drop ending on the back of the female." Summarizing his report, he says: "Judging from these observations, the female takes the initiative in mating. Her calls are continuous for many minutes at a time and are often accompanied by fluttered wings and definite approach towards the male. The male was observed to call only when actually dropping down to the female."

According to my observation, coitus, which often takes place on the branch of a tree, is a noisy, boisterous proceeding, accompanied by a good deal of wing flapping on the part of the male bird.

Nesting.—Unlike most hawks, which either make true nests in trees or lay their eggs on open ledges of bare cliffs, the sparrow hawk, in the great majority of instances, hides its eggs away in deep hollows—either in a natural cavity in a tree or in a hole excavated by a flicker or some woodpecker of similar size.

W. E. D. Scott (1886) speaks of the bird in an arid part of Arizona as breeding "commonly in deserted Woodpecker holes in the giant cacti wherever they flourish", and, in a letter to Mr. Bent, A. Dawes DuBois reports a remarkably high nest "in a hole in a dead branch at the top of a tree, at a measured height of eighty-one feet above the ground." R. C. Harlow (1912) mentions a nest site in "an enormous natural cavity, two feet in diameter", and Bendire (1892) reports an unusual case of its resorting "to holes in sandstone cliffs and clay banks."

Dr. Louis B. Bishop writes to Mr. Bent of a nest in a hole in an elm tree, 20 feet up, in which a female sparrow hawk was "sitting on one golden-eye's egg, with the others and her own eggs around her. The hole was reported to have been used by the golden-eye in previous years."

On rare occasions the sparrow hawk uses an open nest of another bird—a habit it shares with the pigeon hawk. Thus Dice (1918) says: "A nest was found * * * [in southeastern Washington] in an old magpie nest about twelve feet high in an osage hedge", and Rockwell (1909), speaking of sparrow hawks breeding in magpies' nests, says: "The Sparrow Hawk, unlike the preceding species [screech owl], seems to prefer nests which are rooft over, and instances where the eggs are deposited in open nests are quite rare. It is of some interest to note that Sparrow Hawks nesting in this manner are much more timid than those nesting in cavities, and whereas it is a common occurrence to find a brooding female so fearless that it is necessary to remove her from her eggs in a cavity, it is seldom that one can approach within thirty yards of a bird brooding in a magpie's nest without flushing it. Apparently the bird does not feel perfectly secure in a location which is not altogether natural to the inherited instinct of the species."

Since the advent of civilized man to the country, the sparrow hawk frequently makes use of buildings and bird boxes for breeding purposes. The birds habitually use their chosen cavity as they find it. They add little if any nesting material but lay their eggs either on the bare floor or on whatever the previous occupant has left behind. Illustrating this habit Mr. Bent notes a nest "in an old pigeon box, with an outside entrance in the upper story of a barn, a bulky nest of grass at one end of the box—probably an old nest of pigeons", and S. F. Rathbun submits (MS.) the following vivid picture, showing unusual surroundings of a sparrow hawk's nest: "In May, 1932, we were in the elevated plateau section of a county in central Washington. Formerly this part of the county was more or less covered with sagebrush, but now raises much grain. At infrequent times one will come across a building that has been abandoned for some reason, and it is always worth while to look over such a building, for some species of bird may be nesting in it, as that section of the country has a very sparse tree growth.

"We went into such a structure and, on entering a ground-floor room, caught the flash of a bird as it flew from the room through a window lacking its upper sash. There was only one place from which the bird could have flown, a round entrance hole for a stovepipe on the face of the lower end of a brick chimney entering the room on one side from above, the base of the chimney resting on a shelf about 8 feet from the floor. Within the chimney, below the stovepipe hole, was a space 3 or 4 inches deep, which a sparrow hawk was using as a place for nesting. The bottom of this space was rather thinly strewed with droppings from wood rats, there being more than a handful, and mixed with the droppings, were some few bits of rotten bark and wood. On this latter were five eggs that the hawk was incubating.

"This dwelling was overrun with wood rats (*Neotoma cinerea occidentalis*), which had torn into small pieces much of the paper that had been on the walls, evidently using some of it for their nests. Scraps of paper were on all sides, and likewise, scattered everywhere, was excrement from the wood rats. Never before have I seen such a mess. As we walked about, now and then a rat scampered from under foot, and we heard others at work within the walls. There was no sign that the pair of hawks had interfered with the animals, or vice versa, as far as the nest was concerned. Possibly some sort of truce may have existed between the birds and the rats. No one knows."

Miss Althea R. Sherman (1913), who had an exceptionally favorable opportunity to watch from a blind a pair of sparrow hawks rearing their young, has published her observations in detail in an article to which the reader is referred, as only the salient facts can be quoted here and in the section under "Young." She says: "The first egg was deposited on April 28 before eleven o'clock in the morning, and an egg was laid on each alternate day until the sixth, and last, on May 8. * * * Incubation was performed mainly by the female, only once was the male found in the nest. * * * Sometimes it was noted that the eggs were left uncovered nearly or quite an hour, while both birds sat in their tree preening themselves, an exercise in which they spent a vast amount of time."

In common with most birds of prey, a pair of sparrow hawks usually nests far removed from another pair. Charles R. Stockard (1905), reporting an exception to this rule, says: "I found them in Adams County [Mississippi] nesting in a manner almost social or colonial. In a newly cleared field there were many old stumps of deadened trees, some of which were very tall, and many pairs of this little hawk were nesting in these stumps. Some were in natural cavities and others in the deserted burrows of Pileated and other woodpeckers. * * * This clearing was about one mile long and half a mile wide."

Eggs.—[AUTHOR'S NOTE: The sparrow hawk lays ordinarily four or five eggs, occasionally only three, and very rarely six or even seven. The eggs are ovate, short-ovate, or oval in shape; and the shell is smooth but without gloss. The ground color is white, creamy white, or pinkish white, and rarely "light pinkish cinnamon." Usually they are more or less evenly covered with minute dots and small spots, which are often concentrated at one end or in a ring around the egg; sometimes they are more boldly and unevenly marked with larger spots or blotches. The markings are in various shades of brown, "Mars brown", "russet", "tawny", or "ochraceous-tawny"; a few eggs show handsome lavender shell markings. Some eggs are very sparingly marked, or nearly, or quite, immaculate.

The measurements of 169 eggs, in the United States National Museum, average 35 by 29 millimeters; the eggs showing the four extremes measure **39** by **32**, **31** by 28, and 33 by **26** millimeters.]

Young.—Four eggs in the nest under Miss Sherman's (1913) observation hatched on June 4, 5, and 6, showing that the incubation period in this case was 29 and 30 days. Miss Sherman continues:

> Very soon after hatching the young would bite vigorously at a finger that touched their bills, opening their eyes for an instant as they did so, but not until they were two or three days old did they keep their eyes open longer than a few seconds at a time. From their first day they uttered a faint cry, when expecting food, that suggested the scream of the mature Sparrow Hawk, also peeps similar to a chicken but more mournful. * * * There was a third cry, difficult to describe, which they uttered when fed.
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> On June 13 the first manifestations of fear were detected, when the hawklets flattened themselves on the bottom of the nest, but such signs were rare for a few days thereafter. It was on the following day that for the first time they were seen ranged against the sides of the nest their backs to the wall; this arrangement appeared to be the normal one, thus the center of the nest was given to the one that was eating, or to the mother, when she came to feed them. When two weeks old they could run quite well; when placed on the floor of the blind they ran to the inner angles formed by the studdings and the walls, where with backs well braced they faced the foe, and a few days later met with savage claws an approaching hand.

When the nestlings were 16 days old—

> a marked difference was observed in behavior of the males and of the females. When a finger or a stick was pointed into the nest all opened their mouths; the males did little more than this as they hugged the farthest side of the nest but the females, springing to the center of the nest, every feather on their heads standing out seemingly at right angles, wings spread, mouths open and squawking, were ready to claw and bite. * * * When the mother came in there was little clamor and no struggling for food on the part of the nestlings. In their earlier days they merely braced themselves in the circle where they lay, later they stood in an orderly row against the side of the nest. With great rapidity the mother tore the flesh and bending her head almost at right angle with the bill of the young one she gave it the morsel. Her motions in this act were very dainty and graceful; this bending of her head was apparently necessitated by the hooked beaks of both. Sometimes the pieces served were so large that they were swallowed with difficulty. No more than five minutes were occupied in these feedings. At first the food served was "dressed meat," and the remainders of the feast were carried out by the mother, and eaten by her in the dead willow. On June 17, she brought in the body of a half-grown ground squirrel with the skin still on, probably I frightened her out prematurely, since she left the remnant of the squirrel. It was not until a week later that she began regularly to leave the quarry for the hawklets to feed themselves. Thereafter she entered the nest with the food, but remained inside less than a minute, sometimes no more than twenty seconds.

The same difference in temperament between the two sexes displayed by Miss Sherman's birds was shown in a case of some captive young sparrow hawks reported by Harold M. Holland (1923). He says: "Three were females, and it should be recorded that the lone male became, from the first, much the most tractable." He goes on to say that "all exhibited a strong inclination for bathing and in this they frequently indulged."

Dr. John B. May (1927) reports a similar case. He says: "It was interesting to note the difference in disposition between the two birds as their feathers rapidly developed. The female was much wilder from the start, and squealed loudly when approached. The male was very docile and would have made a delightful pet, I am sure."

Plumages.—[Author's note: When first hatched the young sparrow hawk is only scantily covered with white down on the feather tracts of the head, wings, and body. A larger young bird, about 6 inches long, is covered with longer, yellowish-white down, through which the first plumage is appearing on the head, central back, wings, tail, flanks, and pectoral tracts.

The sparrow hawk is one of the few species in which the sexes are decidedly unlike in the juvenal plumage, the color patterns of both sexes suggesting clearly the adult plumages of their respective sexes.

In the young male, the crown, wing coverts, and tertials are "deep plumbeous", with only a hidden trace of the rufous crown patch and with larger black spots on the coverts than in the adult; the upper back and scapulars are "terra cotta", broadly banded with black; the rump and upper tail coverts are "cinnamon-rufous", unmarked; the tail is as in the adult male, but the rufous is more restricted to the central feathers, there is more black-and-white banding on the lateral feathers, the subterminal black band is broader, and there is a broad terminal band of "pinkish cinnamon"; the head markings are much as in the adult; the chin and throat are white, unmarked; the rest of the under parts is "pinkish buff", narrowly streaked on the breast and belly, and heavily spotted on the flanks with black.

In the young female the resemblance to the adult female is even closer. The mantle and wings are like the adult, but the brown is duller, "vinaceous-russet", and the black bars are broader than the brown spaces; the tail is like that of the adult female, but the black bars are broader; the under parts, except the white chin and throat, are "pale pinkish buff", heavily streaked on the breast and flanks with "sepia" or "bister."

These juvenal plumages are worn through summer, but early in fall changes begin to take place, by fading and by a gradual molt of the body plumage, during September and October; by midwinter great progress has been made toward maturity.

During the first fall young birds have a restricted rufous crown patch, with black shaft streaks, which gradually increases and clears.

Meantime, young males become whiter below and some begin to acquire the cinnamon breast, but they are still heavily barred on the back and heavily spotted on the breast. Both of these sets of markings partially disappear by molt during the first winter, but young birds always retain some of these markings, as well as the juvenal tail, until the next complete, annual molt in September and October. Similar progressive changes occur in young females; paler colors are acquired below, with paler and narrower streaks, and narrower, dark bars on the mantle.

Adults have a complete annual molt, mainly in September and October. I believe that the full perfection of plumage is not acquired until the bird is two years old, or more. The oldest males have the least spotting on the scapulars, a clear white or cinnamon breast, with only a few round black spots on the flanks, and the most rufous in the tail; probably successive annual molts are required to reach this perfection. There is a decided seasonal change in appearance, due to wear and fading; the colors are deeper and richer in the freshly molted, fall and winter plumage than in the worn and faded condition of spring and summer. This is especially noticeable in birds from the desert regions.]

Food.—The food of the sparrow hawk includes insects, birds, mammals, reptiles, and amphibians. Its diet varies considerably according to season and locality; hence the contents of a bird's stomach often indicates merely local or temporary conditions. Where grasshoppers abound, they make up the hawk's principal food, birds being captured incidentally, but during winter in northern latitudes this hawk's prey is restricted to birds and small mammals.

The following quotations show the variety of the sparrow hawk's fare:

Dr. Harold C. Bryant (1918) reports from California that one sparrow hawk's stomach contained "15 black crickets"; another "pts. 1 white-footed mouse, pts. 3 Jerusalem crickets, one cricket"; and a third "pts. 5 grasshoppers." Ellison A. Smyth, Jr. (1912) says "they frequent the ivy-covered buildings on the campus [in Virginia], feeding on English Sparrows. The stomach and crop of one individual shot on the campus were densely packed with crickets. * * * I saw one catch a young Robin and perch with it on a telephone pole near one of the buildings, and calmly eat its capture in contempt of the onslaught of several excited adult Robins." Pierce Brodkorb (1928) reports that a bird, "taken April 24, 1926, at Winnetka, * * * Illinois, was found to have fed upon ants."

Francis H. Allen (MS.) says: "I once saw one eating a small snake. Two or three inches of the anterior end of the snake's body (the head had already been eaten) stuck up vertically from the bird's talons, and the hawk took pieces of flesh from the top down as one eats a banana." John B. DeMille (1926) relates the following novel experience: "Aug. 31, while walking the railroad near Gascons [Quebec], on the south shore, a bird darted into the bushes at the side of the track just ahead. I was able to get close without being seen and was surprised to discover him standing on the ground beside a mouse hole, in the manner of a cat. The bird stayed a minute or two and then hopped to an opening in the undergrowth. He flew away empty handed." Lewis O. Shelley, writing to Mr. Bent of the behavior of a captive female sparrow hawk, says that "she would touch no food except living frogs which she killed, eating only the contents of the abdominal cavity." Paul Bonnot (1921) tells of a sparrow hawk which "sailed gently down to one of the [cliff] swallow's nests, passing over a group of about fifteen people, supported himself with one foot, hanging nearly upside down in the meantime, inserted the other foot into the nest, and extracted its owner. The captured bird was an adult Cliff Swallow. The nest was not very deep, and the opening was large."

John Steidl (1928) says that in Illinois he "frequently saw, at the same spot in the road, a small chick in the talons of a Sparrow Hawk," and, accounting for the hawk's departure from its customary diet of insects, he remarks that "for about two weeks preceding the period during which the observations were made there had been a record-breaking period of rainy, cool, and cloudy weather. The insect population was considerably reduced by the weather. In fact, the hordes of insects that often detract materially from the pleasure of night driving at this period were conspicuously absent. It is not difficult to imagine, therefore, that the Sparrow Hawk was forced to turn to other sources of food."

Floyd Bralliar (1922) was successful "in learning exactly how these birds kill their prey, for," he says, "I not only saw them do it at close range, but succeeded in scaring them away without their having time to carry the chick with them. The hawk watches until he feels sure of his prey, then swoops downward straight as an arrow, strikes the bird in the back with his talons, and with his powerful beak tears the top of the head off. The point of the beak is sunk into the base of the skull, and the skull is torn off with a swift forward motion. I succeeded in getting a number of chickens immediately after the hawk struck them, and every one had the whole upper part of the skull torn off, the brain exposed, and the medulla mangled with the point of the hawk's beak."

To see a sparrow hawk strike a bird at rest on the ground is a wonderful sight, but the act is so rapid that "ere a man hath power to say, Behold" it is over. The present is obliterated; we look on something which is past. A long straight swoop, a flash of wings, and the hawk is off with its prey. "So quick bright things come to confusion."

Behavior.—What appeals to us most in this daring little falcon is its lightness and quickness—the speed of lightning compared to the crash of thunder. Whether dashing past with sweeping wing beats, each wing beat carrying it far away; whether cruising along—the tail folded thin and the sharp wings, like a three-pointed star—the wings barely trembling, like the tips of oars just touching the water; or whether soaring against the sky, with tail fanned out, the wings stretched wide, it is always ready to veer like a flash, to mount higher, to drop to the ground, or to come to rest on a little twig.

Often too—perhaps the most remarkable of its aerial accomplishments—the bird, arresting its flight through the air, hovers, facing the wind, its body tilted upward to a slight angle with the ground, its wings beating lightly and easily. Then, sometimes, with a precise adjustment to the force of the wind, it stops the beating of its wings and hangs as if suspended in complete repose and equilibrium, seeming to move not a hair's breadth from its position. It is hunting, scanning the ground for a grasshopper or a mouse.

There are several instances recorded in the literature that show the lighter side of the sparrow hawk's character in its relation to other birds. In some of these the association is of a playful nature as in the case mentioned by Edward R. Warren (1916), who "once saw one Sparrow Hawk after three Redtails", and in that related by

William Brewster (1925), who "saw a Sparrow Hawk amusing himself at the expense of two Flickers. Calling *clac-lac-clac-lac-clac-lac* he would first hover over them for a few seconds, and then dart down close past them, to rise and hover again. Whenever they took flight he accompanied them, describing graceful curves and circles above and around them. That all this was done without malice on his part seemed obvious, and the Flickers evidently so interpreted it, for they showed no fear of him and more than once flew into a tree where he had just settled, alighting within a few feet of him."

Earle R. Greene (1930), in Atlanta, Ga., saw a sparrow hawk "uttering squeaky calls, dart several times toward and very close to the Duck Hawk, which was on a ledge of the dome [of a building]. The Duck Hawk flew away pursued by the Sparrow Hawk for some distance."

W. E. Cram (1901), showing the sparrow hawk in a hostile encounter describes "An Aërial Battle" as follows:

> On September 24, 1898, I witnessed a most vigorous and spirited fight between a Sparrow Hawk and a female Sharp-shinned Hawk. Each seemed equally the aggressor and fought after its own peculiar method of hunting, the Sparrow Hawk always endeavoring to rise high above the other and then dash down falcon-like on the back of its antagonist, a manœuver which the other usually forestalled by turning on its back and striking upwards viciously, though once or twice I fancied that the Sparrow Hawk struck her pretty severely before she was able to turn.
>
> The Sharp-shinned Hawk attacked with a horizontal flight, sometimes with a side movement, but oftener straight ahead, and, to my surprise, appeared to have the advantage when flying against the wind, in spite of its opponent's more compact build and stiffer wing feathers. The two fought back and forth over the same ground for ten minutes or more, each endeavoring to gain the advantage by keeping to the windward, but continually beaten back by the gale. The Sparrow Hawk fought in silence, while the other uttered sharp, petulant shrieks from time to time.

Mr. Bent's notes tell of a somewhat similar case: "A sparrow hawk chasing a red-shouldered hawk. The large hawk had something, apparently a snake, in its talons. Both rose steadily in the air until they were mere specks in the sky, and the small hawk was invisible except through binoculars. It circled above the larger one and frequently darted down at it, as a kingbird would do."

H. I. Hartshorn (1918) notes a contest between a sparrow hawk and a starling in which the hawk had the advantage until it was frightened away. It seems remarkable that so small a hawk should be able to vanquish a bird so nearly its own size, but I can attest that it does so occasionally, for I saw a sparrow hawk carry a starling in its talons to the roof of a building, where, standing on the dead body, the hawk tore it to pieces.

Song birds ordinarily pay little or no attention to the sparrow hawk, especially if it is quiet. Louis B. Kalter speaks in his notes of a hawk perched "in a tree, while white-throated sparrows and juncos fed unconcernedly on the ground below, and a song sparrow sang."

Primarily a bird of the open country and the borders of woodland, and finding most of its food on the ground, the sparrow hawk is commonly seen in the characteristic pose of the falcons—hunched up and frowning—on high, exposed perches from which it can look out over wide stretches of grassland or pasture. It drops easily to the ground to capture a grasshopper or cricket it apparently has seen from a distance, and, on returning to its watch-tower, a telegraph pole or wire, or a branch near the top of a tree, it tilts its tail a few times, swinging it through a considerable arc before settling down to watch again.

We see it scattered numerously through the open flatwoods of the Southern States, and of this region C. J. Pennock remarks in his notes that "they are rarely absent from the edge of the smoke which rises from extensive fires in the pinewoods and marshes, passing back and forth through a considerable pall of the uprising and wind-whirled smoke in pursuit of their winged prey which fly up in advance of the fire." He also tells of a bird that "with its feet picked a 'lizard' from a tree trunk, plucking it off without stopping its rapid flight."

Voice.—The common note of the sparrow hawk is a cry of fairly high pitch—about that of a robin's alarm note—divided into syllables, often six or eight, each one inflected upward a little, *qui, qui, qui,* etc. Although this cry suggests a similar call of the flicker, the delivery of the notes is markedly different in the two birds. The flicker hammers its notes out, as if pounding a piano key over and over, whereas the sparrow hawk delivers them with a lighter touch, each note delicately staccato and set off by the briefest pause. The hawk's voice is not quite a pure tone; it contains a quality of slight roughness—a cry as opposed to a whistle. This note varies somewhat. I have heard it given so as to suggest the call of a yellowlegs—in this case the notes being inflected downward but without the brazen quality of the sandpiper's voice. The syllables *killy-killy,* etc., have long been applied to this note, and often it does have a disyllabic effect.

Francis H. Allen's notes mention "a short, shrill chatter and a note *pee,* with or without a slight rising inflection." This latter note is evidently a modification of *ki-wee, ki-wee, ki-wee,* noted by Knight (1908).

Field marks.—To distinguish the sparrow hawk from the pigeon hawk—the two birds are very close in size and in cut of wing—a glance of the ruddy brown on the back and tail of the former bird is enough.

The sparrow hawk resembles other birds very little. From the mourning dove it is easily recognized by its large head and short thick neck. The semidomestic street pigeon and the sparrow hawk—fellow citizens nowadays in winter—may readily be distinguished by the agility of the hawk, its narrower, sharper wings, and, especially in flight, by its trim slenderness.

Fall.—J. Eugene Law (1915) describes a remarkable migratory flight of western sparrow hawks late in the afternoon of September 13, 1914, in New Mexico. He says: "Thousands sailed by in a continuous stream, all working leisurely south, often a hundred or more in sight from the car window at one time. Individuals frequently alighted on convenient trees and telegraph poles, and all seemed on the lookout for food. The flight seemed to be confined to the vicinity of the river and its adjacent thickets of rank weeds and willows interspersed with stretches of green meadow and alfalfa."

John Treadwell Nichols informs me that he has observed not infrequently an autumnal migration flight of sparrow hawks over the dunes that line the beaches of the southern shore of Long Island, N. Y. On favorable days in September and October they come coasting along, flying alone, although two or three may be in sight at one time, following the shore line to the westward at no great height above ground. On many days he has seen five or six birds pass by in the course of a morning; rarely more than a dozen in a single day and once in a while a pigeon hawk following along with them.

Winter.—As we pass by train through the South Atlantic States during the winter months, the sparrow hawk is one of the common birds we see from the car window. Perched on dead stumps by the side of the cottonfields, flying off from the wires along the track, hovering above the bare brown stubble, we see them again and again, nearly always alone. The traveler soon comes to associate the lone sparrow hawk, the lone red-headed woodpecker, and the flocks of mourning doves with the desolation that winter brings to the Carolinas.

During recent years there have been more and more published records of sparrow hawks spending the winter in some of our large cities. Here they find an abundant food supply, in the flocks of resident house sparrows and starlings, and convenient places to roost, even in the business districts of the city, in the niches of the high office buildings. That they disregard, to a large extent, the proximity of man is well shown by the observations of Nathan Clifford Brown (1906), who, for about four weeks in January and February, watched a bird retire each evening to a recess under the piazza roof of a large hotel in South Carolina. Mr. Brown's observations also show that this bird's motto was—early to bed and late to rise.

DISTRIBUTION

Range.—North and South America. The North American races are found from northern Canada south to Panama. Other races occupy the West Indies and South America south to Argentina.

Breeding range.—In North America the breeding range extends **north** to Alaska (Chitina River); Mackenzie (Fort Good Hope, Fort Rae, and Fort Resolution); central Alberta (Athabaska Landing); central Manitoba (Sea Falls); northern Ontario (Cochrane and Moose Factory); Quebec (Quebec, Godbout, St. Anne des Monts, and Anticosti Island); and Newfoundland. **East** to Newfoundland; Prince Edward Island (North River); Nova Scotia (Pictou and Halifax); Maine (Calais, Bucksport, Lewiston, and Portland); New Hampshire (Franklin Falls and Concord); Massachusetts (Danvers, Boston, and Taunton); Connecticut (Jewett City); Long Island, N. Y. (Smithtown); New Jersey (Princeton, Trenton, Camden, Salem, and Cape May); Virginia (Ashland, Eastville, and Norfolk); North Carolina (Beaufort); South Carolina (Georgetown, Charleston, and Beaufort); Georgia (Savannah, Blackbeard Island, and Okefenokee Swamp); and Florida (Jacksonville, Palatka, Fruitland Park, Fort Thompson, Miami, and Silver Palm Settlement). **South** to Florida (Silver Palm Settlement, Punta Rassa, Tarpon Springs, Tallahassee, Whitfield, and Pensacola); Louisiana (New Orleans and Clinton); Texas (Huntsville, Bellville, San Antonio, Kerrville, and San Angelo); Durango (Rio Sestin); Nayarit (Tepic); and Baja California (Carmen Island and Guadalupe Island). **West** to Baja California (Guadalupe Island and Todos Santos Island); California (San Diego, Twin Oaks, Riverside, Los Angeles, Santa Barbara, Monterey, Santa Cruz, San Francisco, Napa, Mount Sanhedrin, Hoopa Valley, and Crescent City); Oregon (Bandon, Eugene, Newport, and Hebo); Washington (Aberdeen, Olympic Mountains, and San Juan Islands); British Columbia (Courtenay, Alta Lake, and Cariboo District); and Alaska (probably Stikine Flats, probably Taku River, and Chitina River).

Winter range.—In winter the sparrow hawk is found **north** to southern British Columbia (Courtenay, Sumas, Chilliwack, and Okanagan); rarely Montana (Great Falls and Billings); eastern Colorado (Denver); Kansas (Wichita, Independence, and Columbus); rarely Iowa (Cedar Rapids, Iowa City, and Davenport); Illinois (Moline and Rantoul); Indiana (La Fayette and Kokomo); rarely Michigan (Wyandotte, Ann Arbor, and Detroit); rarely southern Ontario (London, Toronto, and Ottawa); New York (Buffalo, Canandaigua, Geneva, and Auburn); rarely southern Vermont (Bennington, Burlington, and Rutland); and rarely southern Maine (Yarmouth). **East** to rarely southern Maine (Yarmouth and Portland); Massachusetts (Plum Island and Boston); Rhode Island (Providence); Connecticut (New London and Hartford); southeastern New York (Orient Point and Staten Island); New Jersey (Princeton and Moorestown); Delaware (Lewes); Maryland (Cambridge); Virginia (Bowers Hill); North Carolina (Raleigh and Pinehurst); South Carolina (Camden, Charleston, and Sea Islands); Georgia (Savannah and St. Marys); Florida (Daytona, Winter Park, St. Lucie, Florida City, and Key West); Yucatan (Camp Mengel); British Honduras (El Cayo); northeastern Honduras (Lancetilla); eastern Nicaragua (Escondido River); and Panama (Gatun). **South** to Panama (Gatun); Costa Rica (Guayabo and San Jose); western Guatemala (Guatemala and Duenas); Oaxaca (Villa Atla); Puebla (Chietla); southern Sinaloa (Esquinapa and Mazatlan); and Baja California (Triunfo). **West** to Baja California (Triunfo, Carmen Island, Natividad Island, Todos Santos Island, Las Cruces, and Calexico); California (Witch Creek, Buena Park, Los Angeles, Santa Barbara, Palo Alto, Berkeley, and Marysville); Oregon (Sweet Home and Rickreall); Washington (Centralia, Tacoma, Seattle, and Everett); and British Columbia (Courtenay).

The range as above outlined applies to the North American races of this species, four of which are currently recognized by taxonomists. The typical race, the eastern sparrow hawk (*Falco sparverius sparverius*), occupies the entire range except the region from southern Nevada, New Mexico, Arizona, southern California, and northern Baja California, which is the range of the desert sparrow hawk (*F. s. phalaena*); the southern part of Baja California, occupied by the San Lucas sparrow hawk (*F. s. peninsularis*); and the peninsula of Florida and adjoining portions of the Gulf States, which is the range of the little sparrow hawk (*F. s. paulus*). Additional races of this species are found in South America and the Caribbean region.

Spring migration.—Early dates of arrival in areas north of the winter range are: Quebec—Montreal, March 25; Kamouraska, April 5; Quebec, April 16. New Brunswick—Grand Manan, March 19; Scotch Lake, April 8. Nova Scotia—Bridgetown, March 22; Wolfville, April 8. Prince Edward Island—North River, April 22. Wisconsin—Racine, March 1 (has been known to winter); Beaver Lake, March 6; Milwaukee, March 8 (has been known to winter); Madison, March 13; North Freedom, March 14. Minnesota—Minneapolis, February 27 (has been known to winter); Jackson, March 8; Hutchinson, March 12; Elk River, March 18. Nebraska—Valentine, February 10; Omaha, February 19; Red Cloud, February 20. South Dakota—Dell Rapids, March 5; Sioux Falls, March 11; Vermillion, March 11; Brookings, March 22. North Dakota—Charlson, March 14; Bismarck, March 21; Larimore, March 22; Jamestown, March 28. Manitoba—Aweme, March 17; Reaburn, March 23; Margaret, March 28; Pilot Mound, April 7. Saskatchewan—Eastend, March 19; Indian Head, March 22; Lake Johnston, March 28. Mackenzie—Fort Simpson, April 25; Hay River, April 30. Alberta—Flagstaff, March 25; Camrose, March 28; Alliance, March 30; Fort Vermilion, April 1; Fort McMurray, April 19. Alaska—Kodiak Island, March 10; Craig, March 11.

Fall migration.—Late dates of fall departure are: Alaska—Juneau, September 11; Craig, September 11; lower Taku River, September 16. Alberta—Beaver River, September 24; Dorenlee, October 3; Banff, October 4; Glenevis, October 17. Mackenzie—Fort Resolution, September 16. Keewatin—Grand Rapids, September 5. Saskatchewan—Eastend, October 2; Indian Head, October 5. Manitoba—Margaret, October 6; Reaburn, October 18; Aweme, October 20. North Dakota—Rice Lake, October 1; Harrisburg, October 3; Charlson, November 1. South Dakota—Lennox, October 21; White River, October 23; Sioux Falls, November 20; Rapid City, November 25. Nebraska—Red Cloud, October 20; Lincoln, October 27; Badger, October 30; Omaha, November 24; Crawford, November 30. Minnesota—Elk River, October 15; Fosston, October 17; Lake Andrews, October 21; St. Paul, November 23. Wisconsin—Trout Lake, October 8; Superior, October 12; Madison, October 18; Beloit, October 22. Prince Edward Island—North River, September 25. Nova Scotia—Pictou, September 23. New Brunswick—St. John, October 17; Scotch Lake, October 21. Quebec—Montreal, October 12.

Among the records of recovery of banded sparrow hawks are a few that help to throw light on the migrations of the species. Of two banded at Norristown, Pa., on June 11, 1932, one was recovered on October 24, 1932, in Nash County, N. C., while the other was retaken at Augusta, Ga., on November 17, 1932. Two others, banded at Huntington, Mass., on June 21, 1926, were recaptured at Newport News, Va., on December 16, 1926, and at East New Market, Md., on March 19, 1927. Another, banded at Saskatoon, Saskatchewan, on July 12, 1935, was killed at Flatonia, Tex., about February 5, 1936.

Casual records.—A sparrow hawk was taken in Bermuda on December 9, 1853.

Egg dates.—Alberta and Saskatchewan: 17 records, May 22 to June 17; 9 records, May 24 to June 3, indicating the height of the season.

New York and New England: 34 records, April 9 to June 12; 17 records, May 12 to 24.

New Jersey and Pennsylvania: 57 records, April 17 to June 3; 29 records, April 28 to May 14.

Florida: 35 records, March 20 to June 1; 18 records, April 6 to 23.

Ohio and Illinois: 12 records, April 23 to June 8; 6 records, May 9 to 26.

Colorado: 15 records, April 28 to July 7; 8 records, May 21 to June 3.

Washington and Oregon: 18 records, March 31 to May 29; 9 records, May 21 to 24.

California: 198 records, March 2 to June 4; 99 records, April 12 to May 3.

Baja California: 3 records, May 11 to 15.

FALCO SPARVERIUS PHALAENA (Lesson)

DESERT SPARROW HAWK

HABITS

When Dr. Edgar A. Mearns (1892) published his study of the sparrow hawks, he characterized this race, under the name *deserticolus*, as follows: "Larger than Eastern *sparverius*, with relatively longer tail. This is a desert form from the treeless regions of the Southwest. It is paler, much more rufous, and with a larger crown patch than in the typical form. The black bars on inner webs of quills do not cross the entire web, as in *sparverius*, but occur as sparse serrations of dusky along outer extremity of shaft, sometimes approaching the condition of whiteness seen in the light phase of *F. dominicensis*, and in some specimens from Florida. Female with more numerous and yellow spotting below, and a redder tone to the under side of the tail. The dark bars of the upper surface are narrower, those of the tail being more often incomplete."

And he gave as its habitat: "Southwestern United States, north to northern California and western Montana, south to Mazatlan in northwestern Mexico." This is a somewhat larger range than we now ascribe to it. The Check-List (1931) now confines it to a breeding range "from southern New Mexico, Arizona, southern California, and southern Nevada south into Mexico and northern Lower California." This latter is doubtless more nearly correct, for we should naturally expect this pale race to be confined to the arid plains and deserts of the Southwest.

Courtship.—Mrs. Florence M. Bailey (1928) publishes the following interesting note from Prof. D. E. Merrill:

> The female was perched on a cross arm of a light pole when the male appeared in air high overhead, and hovered there, both birds squealing vociferously. Dropping back behind a mesquite bush he caught a lizard and flew to her with it in his beak. But instead of accepting his offering, she ungraciously pecked him on the head! "At this he moved away to a safer distance and both began the squealing again, at the same time gesticulating wildly with their heads and bodies. Gaining courage the male once more approached with the lizard. This time the female took it in her bill and immediately and coquettishly dropped it to the ground. A true gallant, the suitor flew down and picked it up again but flew to the next pole to alight. Here he preserved a dignified mien and stern

quiet for some minutes, when the fickle lady-love ceased her clamor and flew to the opposite end of his cross arm. At once he took up cry, alighted beside her and offered the lizard again." This time she readily accepted the offering and the suit was won.

Nesting.—The nesting habits of the desert sparrow hawk do not differ materially from those of the species elsewhere, except where the birds are forced to make use of such cavities as they can find. It evidently prefers to nest in natural cavities in trees where these are available. In southern California we found it nesting in such cavities in sycamores, willows, and cottonwoods. But in a treeless region, near the coast, I saw two or three pairs that were apparently nesting in some burrows near the top of a high cliff. Here the birds were very solicitous and had their favorite lookout posts on little eminences, or peaks, on or near the top of the cliff, which were well decorated with droppings. I had no means of reaching the holes or of digging them out.

In Arizona we found them nesting in natural cavities in trees in the wooded canyons; but out on the deserts, where no real trees of any size are to be found, the only available nesting sites were in the giant cactuses, saguaros. These great candelabra, which tower above the low growth of mesquite and greasewood on the deserts, offer ideal nesting sites for many birds of several species. The abandoned nesting holes of Gila woodpeckers and Mearns's gilded flickers are occupied by sparrow hawks, elf owls, saguaro screech owls, Arizona crested flycatchers, ash-throated flycatchers, western purple martins, and cactus wrens.

Eggs.—The eggs of the desert sparrow hawk are indistinguishable from those of the eastern sparrow hawk. The measurements of 42 eggs average 35.1 by 27.5 millimeters; the eggs showing the four extremes measure **37.8** by 27.4, 34 by **30.1**, **32** by 27.5, and 33 by **22.8** millimeters.

Young.—Mrs. Irene G. Wheelock (1904) gives the following interesting account:

> For the first week the nestlings are fed exclusively on insects; after that, insects predominate in the nursery menu, although mice are brought several times a day. After leaving the nest they are fed in the tree, for a week or so, before they try to hunt for themselves. The first lesson is very interesting to watch. One of the adults brings a bit of food to the youngster, who is sitting on the perch where for several days he has been fed, and instead of giving it to him, lets it fall in full view, at the same time calling "killy-killy-killy." In nearly every case the young hawk springs after it without hesitation the first time this is tried, and he often gets it. The mother is beside, over, and under him as he drops for it, encouraging him with her calls, and he soon responds with a little cry of unmistakable triumph. But he is not allowed to eat it on the ground, as he would like to do. An imperative call from the adult makes the young hunter exert his strength and follow to the nearest low perch before he tastes it.

Food.—The food and feeding habits do not differ much from those of other sparrow hawks, though different species of mammals, birds, reptiles, and insects are included. Dr. John W. Sugden has sent me the following note:

"In the process of feeding, this bird exhibits a distinct preference for the Orthoptera, and in devouring a grasshopper varies but little in the method employed. The insect is grasped by the talons about the abdomen and hind legs. If it is caught in any other position, it is rotated by being held in the beak and regrasped in the correct position by the talons. The grasshopper is held much the same as a child would hold an ice-cream cone. The bird begins by taking several bites of the head. Next the thorax is eaten. The viscera are pulled out and swallowed or occasionally dropped. If dropped, the bird often looks about, as if determining if anything of value has been lost. The first two pairs of legs and the wings are discarded by a flip of the beak. The femora of the third pair of legs are then eaten by taking several bites and the rest of the leg discarded. The abdomen then remains in the talons and, if small, is swallowed in one piece, but, if large, several bites may be taken. If any pieces of food remain on the talons, they are picked off and the bird finishes by cleaning its beak by rapidly brushing it on the perch. Small insects are eaten with a similar procedure and rarely by gulping, as the screech owl invariably does. In feeding on an English sparrow, or small mouse, the hawk holds its prey with the talons and, beginning at the nape of the neck, pulls off strips of flesh. Flies are repeatedly rejected, even if the bird is hungry. Beef is preferred to other meats, and pork is never touched."

In the depths of the Grand Canyon of the Colorado, at 4.35 p. m. on October 30, 1930, George M. Wright (1932) saw a desert sparrow hawk capture and devour a small bat. He says:

> The inner gorge was in shadows, though the sun still brightened the plateau above. The hawk flew low over the edge of the plateau, and while under observation it was seen to be pursuing a small fluttering object which I instantly took to be a bird. My immediate thought was to make sure that it was a sparrow hawk thus engaged in so unorthodox a pursuit. My field glasses were trained on the hawk and followed it while it dived at its prey, which proved to be a small bat. It dived repeatedly, not following the bat about, but striking at it and then gaining a little height before bearing down again. Once, however, it followed the bat into the overhanging recess toward which it was retreating and chased it out again. At about the seventh attempt, the little bat was caught in its talons and carried to the top of the ledge over the recess. The bird remained there for about two minutes, picked at its prize a couple of times and then flew to a rock on the plateau above. In flight, the sparrow hawk was silhouetted against the evening sky and its extended talons could plainly be seen clutching the body of the little bat whose wings appeared to be folded.

Behavior.—We found the desert sparrow hawk really abundant in Arizona and in certain sections of southern California and met with it almost daily in the desert regions of Arizona, where it was decidedly the commonest hawk. Its bright colors and sprightly manners made it one of the attractive features of the region. It could be easily recognized by its manner of flight, when too far away to see its unique color pattern or hear its characteristic notes. It seemed to differ in no way from its eastern relative, as to its behavior. I once saw one attack and drive away a red-tailed hawk from its nesting site.

FALCO SPARVERIUS PENINSULARIS Mearns

SAN LUCAS SPARROW HAWK

HABITS

In describing and naming this race, which is known only from southern Lower California, Dr. Edgar A. Mearns (1892) states that the male is similar to the male of the desert sparrow hawk, "but smaller, with larger, stouter bill, with less black barring on back and scapulars, and scarcely any black spots on the wing-coverts; under side of wing mostly white, the quills being merely serrated with black next to shaft on inner webs; under parts suffused with yellow; very slightly spotted on the sides." And the female is also similar to the female *deserticolus*, "but with a more rufous shade on tail; under parts more yellowish; 'iris yellow,' instead of hazel."

Very little seems to be known about the distribution, and much less about the habits of the San Lucas sparrow hawk. William Brewster (1902) says: "This small, light-colored form of the Sparrow Hawk is of common occurrence in the Cape Region in autumn and winter, but it does not appear to breed there at all numerously, for Mr. Frazar met with it in summer only at San José del Rancho where he notes it as 'very rare'. It is believed to be confined to Lower California, but we have no definite knowledge as to just how far up the Peninsula its distribution extends."

Dr. Joseph Grinnell (1928b), in his latest work on the birds of this region, records it as a "common resident in the Cape district and thence northward to about 28° latitude. * * * Intergradation between the races *phalaena* and *peninsularis* probably takes place between latitudes 28° and 30°." He says further: "Since the above was written, Mr. C. C. Lamb has sent in to this Museum three diminutive Sparrow Hawks obtained October 14, 1927, on the Colorado River twenty miles south of Pilot Knob, January 21, 1928, on the Alamo River twenty miles southwest of Pilot Knob, and February 4, 1928, five miles east of Cerro Prieto. I am unable to distinguish these from Cape-district *peninsularis*. Whether northward vagrants of that race, or representatives of a resident 'colony' of that race on the Colorado Desert, or curiously dwarfed individual variants of *phalaena*, is not now demonstrable."

Nesting.—J. Stuart Rowley writes to me that five nests of this sparrow hawk were located near Mira Flores, Lower California, from May 11 to May 15, 1933, from which five sets of heavily incubated eggs were taken. All the nests were in old woodpeckers' holes in the topmost parts of the cardons (giant cacti), approximately 35 feet from the ground. He says:

> Locating the nests was tedious work. In each instance a male would be spotted perched on a cardon. It was learned that the breeding male was never very far from the brooding female, so a systematic search would start. The extension ladder was set up to every cardon in a reasonable area adjacent to where the undisturbed male was first seen resting. Each likely looking cavity was chopped out until we were rewarded with a discovery or until we became weary and had to give it up. We found that no amount of pounding on the cardon, in which subsequently a brooding female would be found, would flush her from the eggs. The females remained in the holes until the chopping was well done before "exploding" in one's face. The eggs were placed on a few chips of the giant cactus; and the bottoms of the cavities, where the eggs were deposited, were about 16 to 18 inches below the entrance holes.

Eggs.—The San Lucas sparrow hawk lays from two to four eggs. Mr. Rowley took one set of four, two sets of three, and two sets of two, all heavily incubated. The eggs resemble those of other North American sparrow hawks in color but are noticeably smaller. The measurements of 11 eggs average 33.3 by 27.7 millimeters; the eggs showing the four extremes measure **35.3** by **28.2**, **31.5** by 27.2, and 32 by **27** millimeters.

FALCO SPARVERIUS PAULUS (Howe and King)

LITTLE SPARROW HAWK

HABITS

Reginald Heber Howe, Jr. (1902) described and named this small Florida race from a type collected near Miami. He calls it "the *smallest* of the American Sparrow Hawk group. Rufous of upper parts very dark, particularly on the rectrices. *Tail* and wings short. Bill large and heavy." He says further: "The resident Sparrow Hawk of Florida has been referred to several races, but is undoubtedly different from any already described. In fact it is one of the most distinctly separable races of this most interesting group on account of its *very* short tail. It differs from northeastern examples in that its colors are darker, and in its materially smaller size. From *C. s. isabellinus* (Swains.) of northern South America to which it has been referred, it differs in that its upper colors are darker and that its *throat* is immaculate, while in size it is even smaller, its tail being over ten millimeters shorter."

Courtship.—C. J. Pennock says in his notes: "The 'quivering' flight is rarely ever seen except during the mating season. Then, not infrequently, both birds practice it at the same time, in a short and very slow flight out from the nest tree just preceding a final mating union."

Nesting.—During the winter we spent in Pinellas County, sparrow hawks were always very common. In driving to and from our residence on Long Key, we used to amuse ourselves by counting the sparrow hawks sitting on the telephone poles; we could always depend on seeing 6 to 12 in the short drive of 5 miles. We hoped to find them breeding on the island but were disappointed, for they all disappeared before April. We concluded that these were all northern birds, only wintering there. We had not shot any of them.

But we referred to the resident race the birds we found breeding in central Florida, Hernando and Pasco Counties, on April 19, 1925. Here, and in other similar places, we found the little sparrow hawk common. While driving along the roads we passed several places where the flat pinewoods had been burned over, leaving a number of tall, dead, partially burned stubs. Many of these stubs contained holes made by flickers or red-headed woodpeckers, both of which were fairly common. At three of these places we saw sparrow hawks, sitting on the stubs or flying about, so we stopped to hunt for their nests. My companion, Oscar E. Baynard, made some unsuccessful climbs but eventually found three nests. The nests were 20 to 30 feet from the ground in old woodpecker holes, one of which had been broken out. They all held four eggs each; one set was heavily incubated, one advanced somewhat, and one was fresh. Once we saw the bird perched on the nesting stub; in another case we saw the bird fly into the hole; and in the third case, when Mr. Baynard climbed the stub, a flying-squirrel ran out of the hole, and he found two of the four eggs broken (pl. 20).

In another similar burned-over tract in Polk County on April 26, 1925, we found a sparrow hawk's nest containing young and three nests of young Florida screech owls, all in old woodpecker holes.

Donald J. Nicholson writes to me: "This bird begins to deposit its eggs in March, at least from Orange County southward, but the principal time is between April 1 and 15. Occasionally the bird will raise two broods in a season. My reason for such belief is the fact that I found in one day two nests with eggs in mid-June, and several days later found another nest with eggs. These nests were in places where sets are found in April, and none of the nests had been previously disturbed that season. It would seem quite unusual to find this number of very late layings during a normally warm spring."

Eggs.—Mr. Nicholson says that the "sets range from three to five eggs, with four the most common number found. I have no records of more than five eggs." There is a set of six eggs in Griffing Bancroft's collection. The eggs are similar to those of the species elsewhere, except that they average smaller. The measurements of 45 eggs average 34 by 28 millimeters; the eggs showing the four extremes measure 36.6 by 27.4, 33.3 by 29.9, 30 by 28.3, and 34 by 26 millimeters.

Food.—C. J. Pennock says in his notes: "In Charlotte County, Fla., the little sparrow hawk is the resident form and occurs abundantly, feeding largely on insects, so far as I have observed. Thirteen were seen at one time circling about and through the smoke from a raging marsh fire, evidently feeding on winged insects forced to take flight. The stomach of one of these birds contained a katydid and a large winged grasshopper." One day, on the golf course, he saw one twice swoop down at golf balls rolling on the fairway.

POLYBORUS CHERIWAY AUDUBONI Cassin

AUDUBON'S CARACARA

Plates 21–25

HABITS

Audubon's caracara is a northern race of a South American species that reaches its northern limits in Arizona, Texas, and Florida. It is rare in Arizona but fairly common in parts of Texas and Florida. It is locally known as the "Mexican eagle", or "Mexican buzzard", both appropriate names, as it somewhat resembles an eagle in its manner of flight and partially resembles a vulture in its feeding habits.

In Florida it is restricted mainly to the open prairie regions in the center of the State; its center of abundance seems to be on the great Kissimmee Prairie, north of Lake Okeechobee, but it may be found anywhere that similar prairies exist. The Kissimmee Prairie is a large, low, flat, grassy plain, drained by the Kissimmee River and a few small streams; it is dotted with numerous shallow ponds and sloughs, and, especially near the river, there are many small hammocks of large live oaks and cabbage palmettos. Scattered all over the prairie are clumps of saw palmetto, a few scrubby oaks, numerous solitary cabbage palmettos, and an occasional small clump of cypress. In this characteristic home of the caracara, its most conspicuous neighbors are the sandhill crane, nesting in the shallow ponds and sloughs, and the Florida races of the red-shouldered hawk and barred owl, which nest in nearly every hammock. The caracara is not a woodland bird and is seldom seen in the pines and still more rarely in the cypress country.

In Texas its haunts are similar, according to George Finlay Simmons (1925), "open pasturelands and prairies, generally where dotted by oak mottes or crossed by creeks and arroyos narrowly skirted with trees. Mesquite forests typical of the Rio Grande Coastal Plain from Austin southward. Open divides in the wooded mountainous country. Prefers prairies to wooded country, never breeding in tall trees in wooded bottoms. Wanders along streams into the wooded hills."

We found it very rare in southern Arizona, where we saw only one flying across the Santa Cruz River south of Tucson.

Nesting.—We found several nests in the Kissimmee Prairie region near Bassinger, Fla., during the latter part of March. The nests are often so well concealed in the thick tops of the cabbage palmettos that they are very hard to see. One pair evidently had a nest in a small palmetto hammock, as they hung around it for over an hour while I was hunting for the nest. There were numerous droppings and bits of down scattered about, and the birds were flying about, screaming and alighting in the trees near me; but, although I climbed to every likely-looking thick top, I could not locate the nest. Two nests containing young birds, two-thirds grown, were found on March 22, 1925. One was about 25 feet up in a cabbage palmetto on the edge of a live-oak hammock; the nest was barely visible among the green fans in the thick top, resting on the flatter stems; I had to cut away some of the hanging fans before I could reach into it, and only with considerable difficulty even then. It was a bulky structure, loosely made of slender twigs, mainly the fruiting clusters of the palmetto, and was lined with fine bits of the same material. The other was a similar nest, about 30 feet up in the top of a slender, solitary palmetto standing out in an open space; it also held young birds. All other nests seen were similarly located in cabbage palmettos, except one; this was only 15 feet from the ground on a branch of a live oak standing in an open space near a stream; it was made of small sticks.

Frederic H. Kennard found a caracara's nest in the top of a large solitary pine between Fort Myers and Immokalee, Fla. (pl. 22). S. A. Grimes has sent me some photographs (pl. 23) of a nest that he found on the Kissimmee Prairie on February 19, 1934; it was located only 7 feet from the ground in a vine-covered clump of saw palmetto (*Serenoa serrulata*), a very unusual site. The following year, the nest was built 25 feet up in a cabbage palmetto a short distance away. W. A. Smith sent me a photograph of a nest 7 feet up in an oak bush.

Donald J. Nicholson (1929) says that "the caracara is one of the earliest of the raptores to begin nesting in Florida. It begins sometimes early in December to lay eggs. But the height of the nesting activity is in January and February and, even as late as April, nests with eggs are to be found." He says elsewhere (1928) that out of 40 or 50 nests that he has seen, only three were built in oaks and one in a pine; all the others were in cabbage palmettos. "Their nests are made of green tough bushes, broken off by the birds, and sometimes briars, piled up in a heap and trampled down until quite a decent hollow is made. Usually the nests are unlined, but at times a few green leaves or pieces of grape-vines are placed in the hollow. Consequently the eggs rest upon a crude mass of rough, dried stems of bushes."

Capt. R. D. Camp told us in 1923 that the caracara was not so common in Cameron County, Tex., as it used to be. He showed us only one nest, from which he had taken a set of eggs earlier in the season. It was about 8 feet from the ground in the crotch of a Spanish-dagger yucca in open country.

Dr. James C. Merrill (1878) and George B. Sennett (1878 and 1879) both found this species common there at that time. The latter refers to two quite different nests. One "rested on the branches of a sapling only about nine or ten feet from the ground. This small tree was one of a clump which stood under larger trees, and was so slender that great care had to be taken not to shake out the eggs in getting them." Near Lomita, in the taller growth of timber, "two eggs were taken from a nest, forty feet high, in a hack-berry tree."

Herbert W. Brandt says in his notes: "Judging from past accounts, the caracara is on the rapid decline in southern Texas. On four trips from San Antonio to the coast we saw only one bird, where formerly, the ranchers told us, they were plentiful. We found a few breeding on the King Ranch, making their abode about the various windmills. These birds always have the male lookout stationed conspicuously near the nest, and he flushes when the intruder is still some distance away. Every nest we examined was composed entirely of broomweed, and was usually deep, resembling an inverted Mexican hat. The nests are often very bulky and show successive layers. Two-thirds of the sets observed consisted of three eggs, while the remainder numbered two. An interesting nest was found in a huisache tree standing alone in the center of a large, wet, grassy meadow. In the tree was a caracara's nest and 50 nests of the great-tailed grackle, seven of which were crowded under that of the caracara."

Adolph E. Schutze (1904) writes, referring to central Texas:

> The nest is usually placed in the upright branches of an elm or oak, eight to fifty feet above the ground. Of the thirty-five nests that I have so far found, two-thirds are yearly reoccupied, but whether by the same pair of birds, I am unable to say. The birds are always careful in selecting a position where they are enabled to view the entire surrounding country with ease. When an intruder approaches the parent immediately leaves without the slightest noise and is lost to view for a time. After a short while it returns with its mate and both alight on some nearby tree and watch the proceedings with much interest. * * * Of the thirty-five nests that have come under my observation, thirty were composed solely of broomweed and without a lining, two were built of broomweed and small briars, while the remaining three were built of various substances, such as corn husks, small sticks, broomweed, mesquite twigs and the like. Sometimes old nests of hawks are appropriated, and to these are added a few broomstraws, or weeds.

In the desert regions of southern Arizona and Mexico, the caracara sometimes nests in the branches of the giant cactus. It has been said to nest on cliffs. The nests are said to be used for several years in succession, new material being added each season until they become very large.

Eggs.—Audubon's caracara lays two or three eggs, oftener two and very rarely four. These are usually ovate to oval in shape, and the shell is smooth or finely granulated. The ground color, which is usually mostly concealed, is white, creamy white, or pinkish white. Oftener the entire shell is washed or clouded with "light ochraceous-buff", "vinaceous-cinnamon", or "vinaceous-russet"; such eggs are often otherwise unmarked. Usually the ground color, whether light or dark, is largely concealed by irregular blotches, scrawls, splashes, or spots of darker browns, "bay", "chestnut-brown", or "burnt umber." Some eggs with a light ground color are openly spotted, or blotched, with lighter browns, "Kaiser brown", "hazel", or "russet" in pretty patterns. Very rarely an egg is nearly immaculate. The measurements of 57 eggs average 59.4 by 46.5 millimeters; the eggs showing the four extremes measure **74.5** by **54.5, 53.8** by 44.5, and 56 by **43.5** millimeters.

Young.—Incubation lasts for about 28 days and is shared by both sexes. Ordinarily only one brood is raised in a season, but, if the eggs are taken, a second, or even a third, set may be laid. Joseph C. Howell, however, writes to me of an exceptional case of two broods being raised; he says: "On December 27, 1931, Hugo Shroeder and I found a caracara nest with one young, which I estimated was at least 5 weeks old. Returning to this cabbage hammock on March 20, 1932, we observed the birds remodeling the nest. On April 7 the nest held two eggs. This is the only instance I am aware of in which a pair of caracaras have raised two broods in a season. Moreover, this pair must have had a set of eggs in October."

J. K. Strecker, Jr. (1894), writes: "I am told that the young Caracaras occupy the nest for two or three months after they are hatched, which, if so, shows a resemblance to the habits of the young of the Vultures while in the nest. However, although the young Vultures are fed by regurgitation, the young of the Caracara are fed in the same manner as other Falcons, *i. e.*, with fresh meat, although I think that the adults feed quite freely on carrion."

Plumages.—The young caracara, in its natal down, is quite unique and rather pretty. It is completely covered with long, thick, soft down; the upper half of the head is dark, rich brown, "Mars brown" to "auburn"; a large spot on each shoulder, a smaller one on each thigh and one on the rump are "Mars brown" to "mummy brown"; elsewhere the color varies from "pinkish buff" to "pale pinkish buff." A nestling 10 inches long is still mainly downy, but the juvenal plumage is appearing on the scapulars, middle of the back, flanks, and middle of the belly; the primaries are growing.

A larger nestling, nearly grown and nearly feathered, is still downy on the sides of the neck and center of the breast; the tail is just sprouting; the crown, occiput, and scapulars are clear "Natal brown", some of the latter edged with "bay"; the feathers of the upper back are "bister" to "snuff brown", with a large terminal wedge of pale buff and a median streak of "bister"; the wing coverts are "Natal brown", edged with "snuff brown" and tipped with pale buff; the throat, sides of the head, neck, and upper breast are "cartridge buff" to "cinnamon-buff" and unspotted; the rest of the under parts are "Verona brown" to "snuff brown", streaked with "cinnamon" or "cinnamon-buff"; the sprouting tail shows a color *pattern* like the adult tail, but it is barred and broadly tipped with sepia instead of black.

This juvenal plumage is worn until the following winter or spring, but the time at which the postjuvenal molt begins varies greatly, depending on the date on which the bird was hatched; this is very variable, owing to the prolonged nesting season. I have seen birds in full juvenal plumage in December, February, April, and May, the plumage being decidedly worn in many cases. But usually sometime between January and April a complete postjuvenal molt takes place; I have seen the beginning of this molt as early as January 14 and as late as February 25; and I have seen the molt nearly completed by April 14.

The body molt comes first, with the appearance of the spotted feathers on the breast, followed by the rest of the body feathers and then by the wings and tail. This molt produces what is probably a second-year, or subadult, plumage. It is like the adult plumage in *pattern*, breast spotted with small spots, upper back as in the adult, and abdominal region solidly dark; but the light areas are tinged with buff, not pure white as in the adult, and the dark areas are "warm sepia" or "bister", instead of black. This plumage is worn for about a year, or until the following winter; about December or January, or later, another complete molt occurs, which produces the black-and-white adult plumage. Adults apparently have their complete annual molt later in the winter, or even early in the spring. Some adult males that I have seen are only beginning to molt in March; the females may molt even later.

Food.—The caracara shares with the vultures the habit of feeding on carrion, which probably constitutes a large portion of its food. These birds often gather about the slaughterhouses in large numbers with the vultures, to feed on the offal that is thrown out. They also feed on any dead mammal, large or small, bird, or reptile that they can find. They are worthy of protection as good scavengers, as well as destroyers of many harmful rodents and insects, as they hunt and kill many small animals. The following have been recorded in their food: Rabbits, skunks, prairie dogs, opossums, rats, mice, squirrels, snakes, frogs, lizards, young alligators, turtles, crabs, crayfish, fishes, young birds, beetles, grasshoppers, maggots, and worms.

Bendire (1892) quotes William Lloyd as saying: "Although carrion feeding birds, they are very fond of live fish and frogs. I have seen them fishing repeatedly in Sonora, Mexico. In Concho County I have seen them hunting prairie dogs, in couples, and once showing a high degree of intelligence. One was hidden behind a tussock of grass while the other danced before a young lamb, trying to lead it from the place where its mother was grazing to where its companion was hidden. The ruse was nearly successful, as the lamb began to follow, but the dam, anxiously watching, finally called it back."

Bendire himself "saw one of these birds engaged in quite an encounter with a good sized snake which had partly coiled itself about its neck, both bird and snake struggling for a few minutes at quite a lively rate. The Caracara had the best of the fight, however, and before I could get to the place, the bird was off with its quarry, the snake still squirming and twisting about in its talons."

Dr. J. C. Merrill (1878) writes: "I have seen a Caracara chase a jackass-rabbit for some distance through open mesquite chaparral, and while they were in sight the bird kept within a few feet of the animal and constantly gained on it, in spite of its sharp turns and bounds. If one bird has caught a snake or field-mouse, its companions that may happen to see it at once pursue, and a chase follows very different from what is seen among true Vultures."

Mr. Grimes sent me a photograph showing the shells of 43 mud turtles and a box tortoise, the head of a large snapping turtle, a small garfish, and the remains of a bass that he picked up in a few minutes around a caracara's nest that held large young. Twelve heads of small turtles were found in the nest. I wrote to him that I was curious to know how the birds carried the turtles and how they extracted the meat. He responded by spending two hours in a blind near a nest and watching how it was done; he writes to me that he "saw the old birds make five trips to the nest with food for the young. Each of these times, and on three other occasions that I have seen food brought to the nest, the object was brought in the bill. Only one turtle was brought to the nest while I was watching. It was a 5-inch mud turtle, and was held by the edge of the shell, as the bird sailed in with it. The old caracara did not merely leave the turtle at the nest for the young (which were as large as the parent bird) to help themselves; but stayed there 35 minutes, removing the animal from its shell bit by bit and feeding the pieces to her offspring. At a distance of 100 feet I could plainly hear the bird's mandibles clack against the turtle's shell, as she held it down with her feet and strained and pulled at what it contained. After 35 minutes the old caracara turned the remains of the turtle over to the young birds."

Behavior.—The flight of the caracara is somewhat like that of the marsh hawk, with frequent turnings, risings, and fallings, but swifter and more graceful, with rapid wing strokes followed by long periods of sailing. Mr. Schutze (1904) describes it as "very straight and rapid" and says: "On a hot summer's day it can sometimes be seen circling high overhead after the manner of a hawk." Dr. Thomas Barbour (1923) says that "the flight is crow-like, direct, fast and with heavy noisy flappings."

The caracara is quite at home on the ground, where it spends considerable time hunting for its prey. We frequently saw one standing on the bank of a roadside ditch, probably looking for dead animals killed by speeding automobiles, or for fish thrown away by fishermen. Its long legs enable it to walk easily, or even run fast, as anyone knows who has chased a wing-tipped bird.

It is an aggressive bird in pursuit of food and is not afraid to attack even larger birds. I once saw a bald eagle rise from a marshy hammock with what looked like a marsh rabbit in its talons; a caracara, two vultures, and a lot of crows immediately gave chase; the caracara attacked the eagle in the air, plunging down upon it from above; but they all disappeared behind some trees, and we failed to see what happened. Walter B. Savary writes to me that he "saw a marsh hawk, with a mouse in its claws, trying to escape from three crows that were pursuing it in an endeavor to get the mouse. So close at last were the crows that the hawk let its prey drop; without checking its flight, the leading crow snatched up the mouse and continued on, to be at once followed by a caracara who, in turn, forced the crow to drop its prize."

Major Bendire (1892) quotes Capt. B. F. Goss, as follows:

> Brown Pelicans breed in great numbers on an island in the Laguna Madre, off the coast of Texas. When these birds were returning to their breeding ground, with pouches filled with fish, the Caracaras would attack them until they disgorged, and then alight and devour their stolen prey. These attacks were made from above, by suddenly darting down on the Pelicans with shrill screams and striking at them with their talons. I am not certain as to whether they caught any of their prey before it reached the ground. I saw this maneuver repeated a number of times by a pair of these birds that nested on this island and by others that came from the shore. They did not attack outgoing birds, but invariably waited for the incoming ones, and as soon as these were over land (so that the contents of their pouches should not fall in the water) they pounced on them.

Dr. Barbour (1923) has seen caracaras chase large birds and says that "Gundlach once saw one chase, tire out and kill a white Ibis."

H. W. Brandt says, in his Texas notes, that "the abundant scissor-tailed flycatcher makes life miserable for these grand birds by attacking them every time they take to the wing. They often perch on the caracara's back for a mile and leave a wake of pulled feathers." W.

Leon Dawson (1923) tells of one that was attacked by a shrike. Almost any small bird would probably drive one away from the vicinity of its nest, or at least attempt to do so.

W. J. Hoxie writes me that a pair he had in captivity became very tame; he says: "They lived contentedly in a large cage until I went to work on the railroad. A number of years after that, when the male was at the German Club, he knew me so well that, when he escaped and went into the neighboring woods, I called him down out of a tall pine tree and took him back to the club. Some years after that, when he was at the Casino in Isle of Hope, he made such a fuss when he saw me that I had to go and pacify him by scratching his head through the bars of his cage. He was then about 12 years old."

Voice.—The caracara is usually a very silent bird, except for a warning cry to its mate when its nest is threatened. Dr. Barbour (1923) says: "Gundlach notes that when frightened or irritated it gives a high-pitched shriek, but I believe that observation was made from Gundlach's famous pet which he raised from the nest and kept for fifteen years. The Caracara habitually rests perching, usually in the very top of a high tree or on some steep hillock. Often in the morning, or before sundown, it throws back its head until it almost touches its shoulders and gives its high, cackling cry which gave rise to the Brazilian name of Caracara, the Cuban Caraira, and the less apt Argentine name of Carancho."

Field marks.—Audubon's caracara is a well-marked bird. Its pose in flight is much like that of the bald eagle, having a much longer neck and tail and a slenderer form than most other hawks. Its color pattern is also distinctive, especially the head markings; the large white patch in the primaries and the white tail, broadly tipped with black, are both very conspicuous in flight and can be recognized at a long distance. Young birds are much browner than adults, but the pattern is very similar. At short range the eaglelike bill and the red face may be seen. While walking on the ground, it suggests to me a short-legged secretarybird.

Winter.—Being a semitropical species, it is resident throughout the year over most of its range. There is probably some migration from the northern limits of its breeding range, for Dr. Merrill (1878) says that, in southern Texas, it is "more abundant in winter than in summer. This seems to be due to a partial migration, from the north, of birds in immature plumage, for the number of mature individuals does not seem to vary."

DISTRIBUTION

Range.—Southern United States, Cuba, and Central America; nonmigratory.

The range of Audubon's caracara extends **north** to Baja California (Santa Margarita Island and probably San Ignacio); southern Arizona (Tucson); central Texas (Sheffield, San Angelo, Mason, Waco, and probably Houston); and Florida (Manatee River, probably Enterprise, and probably Titusville). **East** to Florida (probably Titusville, St. Johns River, Deerfield Prairie, Fellsmere, St. Lucie, Fort Pierce, Immokalee, and Everglades); Cuba (Trinidad and Isle of Pines); Yucatan (Merida); and Panama (Tapia and Bugaba). **South** to Panama (Bugaba); Costa Rica (San Jose and Nicoya); Nicaragua (Chinandega); Guatemala (Escuintla, Duenas, and Finca El Cipres); Jalisco (Las Penas); and Nayarit (Las Marietas Island). **West** to Nayarit (Las Marietas Island and San Blas); southern Sinaloa (Esquinapa); and Baja California (Cape San Lucas, San Jose del Cabo, La Paz, and Santa Margarita Island).

The typical race (*P. c. cheriway*) is found in South America ranging northward to meet *auduboni* in Central America. The line of contact is imperfectly known, and while specimens from southern parts of Central America approach the northern form in size, in color characters they are more nearly like typical *cheriway*.

Casual records.—Occasional specimens (apparently wanderers from the breeding grounds) have been observed or collected in the northern part of Baja California, as follows: Near Calmali on April 7, 1927; a pair at Santo Domingo; two seen in February on the upper Hardy River; a specimen collected and two others seen near Pilot Knob, Calif., on March 15, 1928. One was observed over a period of two weeks at Monterey, Calif., in February 1916. In Arizona one was shot by an Indian (date uncertain), and two others were reported as seen at Sacaton, while there also is an indefinite record from Oracle. A specimen was obtained at Fort Thorn, N. Mex., during the winter of 1856, and another was taken at Mesquite on May 4, 1914. Although some authors have listed it as fairly common in Louisiana, the only definite record appears to be a specimen listed in the catalog of the National Museum as taken at Calcasieu Pass in 1854.

At one time the species apparently had a wider range in Florida, as its discovery by Audubon on November 24, 1831, was near St. Augustine, and in 1858 it was recorded from Enterprise. One was observed "at close range" at Pineycreek, N. C., on February 19, 1933, and one was found dead on the north shore of Lake Superior near Port Arthur, Ontario, on July 18, 1892.

Egg dates.—Florida: 30 records, December 28 to April 7; 15 records, January 30 to February 28, indicating the height of the season.

Texas: 80 records, January 30 to June 4; 40 records, March 15 to April 18.

Mexico: 10 records, March 2 to August 10; 5 records, March 6 to May 10.

POLYBORUS LUTOSUS Ridgway

GUADALUPE CARACARA

HABITS

The history of this extinct species is a tragic story. It seems sad that such a unique and interesting species should be wiped out entirely; but it was a bad actor, and whenever a beast or bird interferes too much with human interests its days are numbered, unless it proves more than a match for its human enemies, as does the crow. This bird was not endowed with sufficient sagacity to survive, and was too easily exterminated in its limited range.

This interesting species was discovered by Dr. Edward Palmer, when he visited Guadalupe Island in 1875. The "quelelis", as these birds were called by the inhabitants, were then abundant on every part of the island, in spite of the fact that hundreds of them had been destroyed by the inhabitants, both with poison and firearms, without any noticeable diminution in their numbers.

Ten years later, when Dr. Walter E. Bryant visited the island, the number of these birds had decreased very materially. He (1887) writes:

> In January, 1885, during a two days' excursion about the central part of the island, but four "Quelelis" were seen. By 1886 their number had been reduced by more than a score by the island agent, who never missed an opportunity to kill one. Arriving on the island in the summer time, when the birds came to the shallow pools to drink, the agent would lie in wait behind a boulder and pick them off with a rifle. The birds, if missed, heeding not the shot, or, if but slightly wounded, not realizing the danger, remained near, making certain the destruction of all that came to drink at the fatal spring.
>
> During my rambles I frequently came upon the weather-beaten carcasses of "Quelelis" lying where they had fallen. In one place, four were found lying dead together.

Later (1889) he says:

> So effective has been the work of extermination carried on against this bird that Dr. Edward Palmer who first discovered them in 1875, says that he visited the island this year (1889) and did not see a single individual. He tells me that when he landed, fourteen year ago, the "*quelelis*", as they are known there, were so numerous and bold that men were obliged to stand over the angora goats with sticks to protect them from attack, particularly the kids, which were not defended by their mothers. The short-haired kind will drive off the birds, so Dr. Palmer says, from his observation. Now that man has abandoned the island I cherish the hope that a pair at least may still be living, and that some future explorer may succeed in finding the unknown eggs, and give us an account of the nesting habits of this peculiar insular species.

Four were reported seen by some goat hunters in 1896, Henry B. Kaeding (1905) saw one on March 22, 1897, and Rollo H. Beck secured 9 out of 11 caracaras that flew over him on December 1, 1900; he says in a letter to Clinton G. Abbott (1933): "The 11 birds were all that were seen, but judging by their tameness and the short time that I was on the island, I assumed that they must be abundant." This is the last record we have of birds being seen by a competent ornithologist. W. W. Brown and H. W. Marsden spent two months on Guadalupe Island in 1906; "the island was ransacked from end to end, but no trace of the caracara could be found. Goats were killed and left at various points on the island, especially upon the high, open tableland, where the caracaras, had there been any, must have detected them, but nothing came to any of the many carcasses that were thus exposed" (Thayer and Bangs, 1908).

The "dark colored birds" seen by Capt. Charles E. Davis in 1913, reported by Harry S. Swarth (1913), must have been something else, perhaps immature gulls. Mr. Abbott (1933) has published an interesting paper on the closing history of this bird and the histories of existing specimens. He found a total of 37 recorded specimens, of which he was able to locate 34; of these, 14 skins and one skeleton are in the United States National Museum.

Nesting.—Very little is known about the nesting habits of the Guadalupe caracara, and hardly anything that is really authentic. H. Kirke Swann (1925) writes: "Curiously enough, although the nests must have been common thirty or forty years ago, no eggs appear to have been preserved except the single one in my own collection. This oological rarity was taken on the island by W. More on April 17th, 1897. The nest was a huge affair of sticks on the top of a pile of rubbish and cacti. Only two pairs of birds were seen and the ♀ of this pair was shot."

The Mexicans told Dr. Bryant (1887) "that a cliff was always chosen for a nesting place, thus making their nests difficult to find and still more difficult of access."

Eggs.—The egg in the Swann collection is probably authentic. He says of it: "The egg resembles a pale egg of *P. cheriway auduboni*, but is rather smaller; size 55 by 43 mm. It has a whitish ground obscured by heavy spotting and blotching of dark reddish brown. This egg is figured on the plate accompanying pt. I."

Charles E. Doe has an egg in his collection, which appears to be genuine; it was taken on Guadalupe Island on "3-4-80" and measures 67 by 50 millimeters. Mr. Doe describes it as a light-colored egg, much like figure 4 on plate 11 in Bendire's (1892) work. No nest description came with it.

Plumages.—Robert Ridgway (1876) has described the plumages of the Guadalupe caracara very satisfactorily. Of the downy young, he says: "Four young birds taken from the same nest differ remarkably in size and general development, the smallest being apparently just hatched, while the largest is nearly one-third grown, with well-developed feathers in the wings and tail. The other specimens were intermediate." One of these, which I have examined, looks much like a young Audubon's caracara. It is covered with thick down, "chamois" to "cream-buff" in color; the pileum and a large patch on each scapular region, extending over the upper side of the wing, are "snuff brown" to "sayal brown."

Mr. Ridgway (1887) describes the immature bird, as follows: "Quills, tail, tail-coverts, head, and lesser wing-coverts much as in adult; rest of plumage more or less distinctly striped with dull brown and dirty brownish white or dull buffy, the former prevailing, and sometimes nearly uniform on upper parts."

Food.—Like other caracaras, the Guadalupe bird was largely a carrion feeder. Wherever the carcass of any animal or bird was left in the open, these birds were sure to gather. Dr. Palmer (Ridgway, 1876) says: "Besides the principal sources of food-supply already indicated (see below), the birds have other means of subsistence. They eat small birds, mice, shell-fish, worms, and insects. To procure the latter, they resort to plowed fields, where they scratch the ground almost like domestic fowls." Dr. Bryant (1887) writes: "Their food during the season of caterpillars consists almost entirely of these larvæ, with a slight variation afforded by occasional beetles and crickets. Whenever opportunity offers they are ready to gorge themselves upon the offal of a slain goat, retiring after the banquet to a convenient tree to await the process of digestion. I have never known of their eating the bodies of their own species, but they do not object to making a meal off the flesh of a fat petrel if fortune casts a dead one in their way."

Behavior.—Dr. Palmer says in his notes, quoted by Mr. Ridgway (1876):

> The "Calalie" is abundant on every part of the island; and no bird could be a more persistent or more cruel enemy of the poultry and domestic animals. It is continually on the watch, and in spite of every precaution often snatches its prey from the very doors of the houses. The destruction of the wild goats is not so great, as these animals are better able to protect themselves than the tame ones. No sooner is one kid born—while the mother is in labor with the second—than the birds pounce upon it; and should the old one be able to interfere, she is also assaulted. No kid is safe from their attacks. Should a number be together, the birds unite their forces, and, with great noise and flapping of their wings, generally manage to separate the weakest one and dispatch it. They sometimes fasten upon the tongue when the poor creature opens its mouth to bleat, and have been known to tear it out, leaving the animal to perish, if not otherwise destroyed. Sometimes the anus is the point of first attack. The birds are cruel in the extreme, and the torture sometimes inflicted upon the defenseless animals is painful to witness. They occasionally, when pressed by hunger, attack full-grown goats; numbers harass it together from all sides at once, and soon put it to death. A "burro" (jackass) which had accidentally become wedged among some rocks, was once furiously attacked and lost its eyes before assistance reached it. Even when food is plenty, they often attack living animals instead of contenting themselves with the carcasses of those already dead, seeming to delight in killing. Should one of their number be disabled or wounded, it is instantly dispatched by the rest.

Dr. Bryant (1887) writes:

> Being of an unsuspicious character, they will allow a person to walk directly towards them until within shooting distance, merely watching the intruder until the distance becomes less than agreeable. If they happen to be upon the ground they beat a retreat at an awkward walk or, if necessary, a run, taking wing only as a last resort, and even then flying but a short distance before alighting. Their actions, gait, and positions, while on the ground are similar to those of a buzzard. In flight, the light color on the primaries is distinctly shown.
>
> During several consecutive days, a "Queleli" came to my camp, searching for scraps of food. One day I saw him making off, at a walk, from the cook house, carrying with him a piece of bone from the leg of a goat, and upon which a little raw meat still adhered. With this bone, fully nine inches in length, grasped firmly in his bill, he retired to what he considered a safe distance before commencing his feast.
>
> As far as my observations went, the birds were entirely silent, but the agent informed me that when perchance a rifle ball carried away a wing or a foot, the unfortunate bird would scream long and loudly. If the wounded creature happened to be in company with others of his kind, he would be immediately attacked and killed. One which was badly wounded attempted to escape by running, with the assistance of his wings. Being overtaken and brought to bay, instead of throwing himself on his back in an attitude of defence, or uttering a cry for quarter, he raised his crest and with an air of defiance, calmly awaited death as became the Eagle of Guadalupe. Weakened by the loss of blood which poured from a wound in his throat, he finally fell forward and died—silent and defiant to the last.

Voice.—Dr. Palmer's notes (Ridgway, 1876) state: "When surprised or wounded they emit a loud, harsh scream, something like that of the Bald Eagle. In fighting among themselves, they make a curious gabbling noise; and under any special excitement the same sounds are given forth, with an odd motion of the head, the neck being first stretched out to its full length and then bent backward till the head almost rests upon the back. The same odd motions are made and similar noises emitted when the birds are about to make an attack upon a kid."

DISTRIBUTION

Range.—Formerly Guadalupe Island. Now extinct.

Order STRIGIFORMES: Owls

Family TYTONIDAE: Barn Owls

TYTO ALBA PRATINCOLA (Bonaparte)

AMERICAN BARN OWL

Plates 26–30

HABITS

The North American form of this world-wide species is widely distributed throughout the warmer portions of the United States; it is rare in the northern tier of States, north of latitude 41°, but it increases in abundance southward and is especially abundant in southern California. It is widely known locally as the "monkey-faced owl" and has also been called "white owl", "stone owl", and "golden owl", the last a pretty and appropriate name.

Owls have always been victims of ignorance and superstition, believed to be birds of ill omen and harbingers of misfortune and death; and the barn owl, in particular, has been responsible for many reports of haunted houses. But, in spite of its sinister appearance and its ghostlike habits, this curious owl is one of our best feathered friends, most worthy of encouragement and protection, as a most efficient living mousetrap.

Nesting.—As I have had very little experience with the barn owl, I quote the following comprehensive statement by Bendire (1892):

> Their nesting sites are quite variable and include all sorts of places, such as natural hollows in trees, holes and cavities in clay banks or cliffs, burrows under ground enlarged to suit their needs, in the sides of old wells, abandoned mining shafts, dovecots, barns, church steeples, etc., and sometimes, though rarely, in perfectly exposed and unprotected situations, such as the flat roof of an occupied dwelling-house in the midst of a village.
>
> Mr. W. O. Emerson, of Haywards, California, writes me: "A pair of Barn Owls nested the past season (1889) on the bare tin roof running around a cupola of a neighbor's house, which was surrounded by a low railing. Not less than twenty-four eggs were laid and none of them were taken away at any time. There was no nesting material on which the eggs were placed, not even a single twig, and they naturally rolled around on the roof, as it was impossible for the bird to cover them all. When taken down finally and examined, it was found they were all rotten, caused, no doubt, by the intense heat from the sun's reflection on the tin roof."

Writing of his experience with the barn owl in Arizona, Major Bendire (1892) says: "In this vicinity I believe they nest mostly in deserted burrows of badgers, at any rate more than once I saw them sitting in the mouth of such burrows."

The only nest of a barn owl that I have ever examined was shown to me by E. Lowell Sumner, Jr., near Claremont, Calif., on February 28, 1929 (pl. 26). It was in a large, horizontal, natural cavity, about

12 feet from the ground, in a thick, gnarled branch of a low-spreading live oak; the owl flew out, as I climbed to the nest, and did not appear again; the cavity was so deep that I could barely reach the eight eggs that lay at the farther end on a bed of rotten chips, rubbish, and bits of down. The nest had been occupied on previous occasions.

As far as I can learn, from the experiences of others, the barn owl shows a decided preference, in California at least and apparently in Texas also, for nesting in cavities, holes, or burrows, in cliffs or steep banks, which are easily found or made in the numerous barancas or gullies to be found in that region. Dr. B. W. Evermann (1882) says:

> The site selected for the nest is most usually a hole or crack in the wall of a baranca or cliff. During the past season, I examined more than thirty nests, at least five-sixths of which were thus located. The entrance to these holes, if in barancas, is usually eight to ten feet from the surface of the ground; if in cliffs, any suitable place on the face is selected. The cavity usually extends inward nearly horizontally for a foot or more, then bends down slightly, continuing at that angle for two to three feet, slightly widening to the end where it is quite commodious, being often as much as two feet in diameter. For some time it was a preplexing question to me as to *how* and *by what* these holes were excavated. After careful investigation, I am convinced that the owls themselves make many of them. A slight crevice or squirrel hole is selected, and, with their powerful claws, they hollow it out to proper dimensions. Both birds are frequently found occupying the cavity during the day,—the male to one side of the nest.
>
> * * * We visited a deep baranca a few miles east of Santa Paula, where we knew them to be abundant. * * * We dug down to eleven nests altogether, from six of which we got *forty-four eggs*, ranging from six to *ten* eggs to the nest.
>
> But the burrows are not always selected. Two nests were found in holes in oak trees, one was found in a barn, * * * and in April, 1880, I found a pair occupying the deserted nest of a crow, which was placed about twenty feet from the ground in a cottonwood. I visited this nest at two different times before taking the eggs (five in number), and drove the female from the nest on each occasion. The use of a nest of this kind by the Barn Owl is very rare, I think; careful search failed to discover a second instance of this kind.
>
> * * * As to whether it constructs any nest seems to depend entirely *where* it nests; if in holes in cliffs, trees, or walls, no lining is used; if in barns or houses, it constructs a rude nest of sticks or other rubbish easily brought together.

Julian K. Potter and John A. Gillespie (1925) made some extensive studies of the home life of a pair of barn owls near Gloucester, N. J. The nesting site was in an old tower (pl. 27), "a frame building of three stories shaped like a truncated pyramid, with a water tank at the top. It was in an extremely dilapidated state of repair, and the window panes were entirely missing." The nest was in a "hole in the floor just in front of the stairway leading to the roof and about three feet from the open window. * * * The nest cavity was approximately twenty inches deep, fifteen inches wide and eight inches high, the sides being formed by vertical floor beams, and the top and bottom by the floor and the ceiling of the room below. * * * No nesting material of any description was in evidence except a small clump of black feathers which possibly once belonged to a Starling."

Ivan R. Tomkins writes to me that "a nest of the barn owl was found in one of the steel range lights on the Savannah River, March 30, 1929, with five eggs (pl. 27). The nest was in a steel box about 2 feet square, with part of the west side open to the sun, under the light, and was liberally carpeted with pellets. The keeper of the light says the owl has nested there for about four years."

A. B. Howell (1912), referring to the Todos Santos Islands, writes: "April 16 I found a nest in a deep cleft in the rocks, twenty feet above the sea, which contained a single nestling two-thirds grown. This site was newly occupied, but on a ledge four feet above the floor of a cave on the higher ground was a nest that must have been used for generations. Beneath it was a pile of refuse and pellets two or three feet high."

W. E. D. Scott (1892) reports "a pair breeding on the hull of an abandoned dredge that had belonged to the company engaged in draining and reclaiming land in the vicinity of Lake Okeechobee."

Eggs.—Major Bendire (1892) says: "The average number of eggs laid by this species is from five to seven, seldom less. Larger sets containing from nine to eleven eggs are by no means uncommon; it is questionable, however, if every egg in such large sets is usually hatched.

"In shape the eggs are mostly ovate, a few are elliptical ovate, and a single specimen before me is elongate ovate. They are pure dead white in color, the shell is finely granulated, and they are decidedly more pointed than Owls' eggs in general."

The measurements of 59 eggs average 43.1 by 33 millimeters; the eggs showing the four extremes measure **48.8** by 32.5, 43.5 by **35**, **39.8** by 33.3, and 40.5 by **27.5** millimeters.

Young.—The eggs are laid at intervals of two or three days, and incubation begins soon after the first egg is laid; consequently the young hatch at similar intervals and vary greatly in size. The period of incubation is said to be from 21 to 24 days. Bendire (1892) says that "both sexes assist in incubation, and the pair may be sometimes found sitting side by side, each with a portion of the eggs under them."

E. L. Sumner, Jr. (1929) has made some intensive studies of young barn owls. On March 4, 1928, he found that three of a set of eight eggs had hatched, and says in his notes: "All three whimper continually, in feeble tones. The oldest is able to stand up, although weakly and with nodding head." On March 10, only two eggs remained unhatched. On the 17th, the oldest "hisses harshly when handled, but is still quite docile. It stands up and walks about with ease." March 26: "The youngsters are quite lively, even the smallest. When set down in the long grass they stand up to their fullest height and crane their necks in search of a hiding place. As yet, all the birds can be handled without danger. When disturbed, a and b (the oldest two) hiss harshly and sway from side to side with heads lowered and extended wings inverted, after the manner of owls. If further provoked they throw themselves on their backs and strike out with both feet." April 16: "Youngsters more active and aggressive than ever. When placed on the ground they strike at each other, as well as at any other object that comes within range, and at times they even assume the offensive; running toward me with open beaks and upraised, inverted wings."

From that time on, the young became more pugnacious, until, on April 27, he called the "actions of young positively unprintable"; and on the 6th of May, he had to tie them down to keep them from flying away. On May 27, the youngest bird left the nest. An interesting discovery was that, when between six and seven weeks old, every one of the birds began to lose weight, though before that they had exceeded the average weight of adults.

Messrs. Potter and Gillespie (1925) made several visits to the barn owl's nest in the old tower, referred to above. On their second visit, on May 13, 1924, the nest contained seven young, three days to two weeks old. The youngest "was a pitiful, bedraggled and filthy little fellow, having evidently been trampled on by the others. In size he was little larger than a baby chick, and at times he uttered a faint, tremulous whine. The rest were of assorted sizes, the largest about the size of a Pigeon. Dark colored pin feathers were in evidence in the wings of the two largest. * * * The cavity was inspected and was found to be in an exceedingly filthy condition,—the floor covered with a layer of casts powdered into a furry mass by the feet of the young. Yet in such unsanitary surroundings the fledglings, with the exception of the smallest, were clean, except their feet, which were quite filthy."

On June 9, "dusk was falling, but it was still light at eight p. m. when one of the young ones made the initial call for food. This is a rasping, sucking noise, and can readily be imitated by drawing in the breath sharply through the corner of the mouth, keeping the teeth closed. This is, no doubt, the 'snoring' call described by Dresser (Knowlton, 'Birds of the World,' page 516). It might also be likened to the sound made by an ill-mannered person eating soup! It actually sounds as if the bird's mouth were watering in anticipation of food, and it kept sucking back the saliva. The others soon joined in the call, which by eight-fifteen was very insistent."

At 9.00 p. m., "adult Owl drops on window-sill and then to floor as before. We flash light on her. She stands at entrance to nest peering down. Either a pine or a short-tailed field mouse hangs from her bill by the back of its neck. She appears to be waiting for the young to take the mouse, but they are raising a great racket under the floor, apparently afraid of the light. The adult bird disappears into the cavity, feeds the young and reappears. The light seems to daze her as she looks toward us with black, blinking eyes. * * * Suddenly she jumps and flies directly toward us, lighting on the stairs about seven feet from where we sit. * * * Then she seems to spy the window and silently glides out into the night."

Another, similar feeding was observed at 9.18. Summing up their observations, they say: "Both adults participated in the feeding. Female an 'earlier riser,' her earliest visit made at 8.20 P. M. while male put in his initial appearance at 9.45 P. M. Under normal conditions the feedings no doubt continue throughout the night, but during our observation the adults were frightened and paid fewer visits. Feedings were in the ratio of two by the female to one by the male. The first evening the bringing of food was witnessed, the female, obviously suspicious of our presence but not alarmed, brought three mice within a period of fifty-three minutes."

They learned by subsequent observations that the young owls were ready to leave the nest and fly out into the world "seven and one-half to eight weeks subsequent to hatching." And they inferred, from the sounds heard and the behavior of the adults, that the young lived in the surrounding trees and were fed by their parents for some time after leaving the nest. They describe the following calls of the young:

> (1) A high-pitched quavering whine uttered by recently hatched fledgling before eyes were open.
>
> (2) A loud hiss uttered through the open mouth, expressing alarm. As the fledglings develop in size this hiss gradually changes into a throaty, hissing scream devoid of tone, which presumably later becomes the adult "scream."
>
> (3) A short rasping call, or "snore" (Dresser). This is the food call and varies considerably in pitch.
>
> (4) A discordant scream, similar to that of the adult, but of shorter duration and higher pitch. Uttered on the wing at age of approximately 10½ weeks.

A young bird handled by Howard H. Cleaves (1910) uttered "a plaintive *chi-le-le-le*, *chi-le-l-le*, *chi-le-le-le*, repeated very rapidly."

Plumages.—The young barn owl is easily recognized at any age by its much prolonged and pointed face, exceeding all other owls in this respect. It also differs from other owls in its sequence of downs, having at first a fuzzy, white down, which is followed by a woolly, buffy-white down; it never acquires a long, fluffy, soft, juvenal plumage, so characteristic of other young owls; this is probably due to the fact that the first winter plumage is acquired at a very early age and is nearly complete when the bird leaves the nest. E. Lowell Sumner, Jr. (1933) has described this very well as follows:

> The fuzzy white nestling down is the only covering of the young barn owl until about the sixth day. At this time the buff-colored second downy plumage begins to appear, and carries the earlier down away on its tips. This second down rapidly develops into the thick, woolly covering which is so characteristic of young barn owls, and remains as a conspicuous feature until the bird is about fifty days of age. At this time close examination reveals traces of the short nestling down still adhering to the tips of the second coat through which, on the wings, the dark tips of the developing primaries are beginning to push their way. The rest of the contour feathers are as yet invisible and have not emerged from the follicles.

Mr. Sumner's plates (1933) show that at an age of 26 days the primary quills are beginning to burst their sheaths, but the wing coverts are still downy; at 44 days the primaries are well advanced, and the down is rubbing off, disclosing the first winter plumage; at 66 days the development of the wing is practically complete.

Potter and Gillespie (1925) describe the development of their young barn owls as follows: "Pin feathers in wings appeared in approximately twelve days. Primaries and tail feathers acquired in approximately three weeks. Complete wing and tail feathers acquired in five to five and a half weeks. Complete adult plumage acquired in approximately seven and a half weeks."

Most authors state that the first winter plumage, which is the first real plumage, is like that of the adult, but it seems to me that there are some slight differences; the gray "pepper and salt" markings on the upper parts are less extensive and more mixed with buffy tints; the crown and hind neck, which are uniform with the back in adults, vary from "cinnamon-buff" to "cream-buff", sparingly spotted with the black and gray spots.

This plumage is worn, without molt and with very little abrasion, until the annual, complete molt, which takes place in both young and adult from July to November. There seem to be two color phases in adults, which Baird, Brewer, and Ridgway (1905) describe as follows: "Darkest: There is no white whatever on the plumage, the lower parts being continuous light ochraceous; the tibiae have numerous round spots of blackish. Lightest: Face and entire lower parts immaculate snowy-white; facial circle white, with the tips of the feathers orange; the secondaries, primaries, and tail show no bars, their surface being uniformly and finely mottled. * * * The variations of plumage noted above appear to be of a purely individual nature, since they do not depend upon the locality; nor, as far as we can learn, to any considerable extent, upon age or sex."

However, in a large series that I examined, I noted that the males averaged lighter above and whiter below, often pure white below, with only a few scattered small spots of sepia, and with whiter faces. The females, on the other hand, averaged darker everywhere, the breasts, flanks, and tibiae being often "cinnamon-buff", deepest on the tibiae, with more, larger, and darker spots; and the faces were more tinged with brownish. As this was not a universal rule, however, it may mean only individual variation, or indicate two color phases. Similar variations were evident in the younger birds, so it is not an age character.

Food.—All authorities agree that the barn owl is one of our most useful birds of prey, as its food consists almost entirely of various species of rodents that, from their abundance and destructive habits, are a curse to agriculture and other human interests. Dr. A. K.

Fisher (1893b) reports that "of 39 stomachs examined, 1 contained poultry (pigeon); 3, other birds; 17, mice; 17, other mammals; 4, insects, and 7 were empty." He says that "in California the favorite food of the Barn Owl is a species of pouched gopher. The pouched gopher is one of the most destructive of this group, not only to vegetable and grain crops, but also to shade and fruit trees. The depredations in the latter case, which consist in the gnawing or entire removal of the roots, are the most serious as they often result in the total destruction of groves and orchards. All the stomachs and pellets which we have received from that State contained the remains of this animal."

He quotes Dr. B. W. Evermann (1882) as follows: "Their food consists principally of the gopher (*Thomomys talpoides bulbivorus*) and the California ground squirrel (*Spermophilus grammurus beecheyi*), both of which are so destructive to growing crops and fruit trees on the Pacific coast. Other small mammals, particularly rabbits, birds, and insects go to make up its bill of fare. * * * This owl is not large, yet it must be a very strong and courageous bird, as evinced by the fact that I have often found in its burrows portions of the large jackass hare (*Lepus californicus*) or 'narrow-gauged mule,' as popularly known in California."

In the East the barn owl lives largely on rats and mice, and in the South, where the cotton rat is abundant and very destructive, its food, according to several observers, consists almost exclusively of this rat.

Dr. Fisher (1893b) examined the nesting site of a pair of barn owls in one of the towers of the Smithsonian Building in Washington, and says:

"The floor was strewn with pellets, and the nest, which was in one corner, was composed of a mass of broken-down ones. An examination of 200 of these pellets gave a total of 454 skulls. Of these, 225 were meadow mice; 2, pine mice; 179, house mice; 20, rats; 6, jumping mice; 20, shrews; 1, star-nosed mole, and 1, vesper sparrow (*Poocætes gramineus*)."

Dr. Charles W. Townsend (1926) reports that 56 pellets of the barn owl, found in the attic of an old rice mill near Charleston, S. C., contained the remains of the following mammals and birds: 2 small shrews, 65 rice rats, 1 cotton rat, 7 red-winged blackbirds, 12 sora rails, and 4 clapper rails. Commenting on this unusually large percentage of birds, Dr. A. K. Fisher wrote to him: "Although the matter can not be proved, I am wondering whether rails and other birds that in a way simulate the movements of rats and mice in the thick foliage might not be taken by accident rather than intentionally by the Owls. This theory would seem to have some weight because they do not molest pigeons that are breeding in adjoining apartments or any species that are not found on the ground around marshes or fields."

Paul Bonnot (1928) tells another bird-killing story, of a pair of barn owls on an island off the coast of California, as follows: "There was an old cabin on the Island which had fallen partly to ruin. Under a built-in wooden bedstead was the nest of a Barn Owl. * * * The area covered by the bed was three inches deep with feathers, wings and bodies of Beal Leach Petrels (*Oceanodroma leucorhoa beali*). These little birds were evidently so easily caught that there were numbers of bodies with only the heads removed, and I collected for study three specimens with hardly a feather misplaced. A good number of the bodies of the petrels were rotting and inhabited by fly larvae."

It is when the young are being fed in the nest that these owls do their best work in the destruction of rats and mice, for the young require an enormous amount of food. W. L. Dawson (1923) writes: "Tyler, of Fresno, found a nest containing four very small birds and six eggs, for which the following provision had been made: five Pocket Gophers (*Thomomys*), five Kangaroo Rats (*Perodipus*), one Pocket Mouse (*Perognathus*), and two White-footed Mice (*Peromyscus*)." And W. L. Finley (1906) says:

> An old owl will capture as much or more food than a dozen cats in a night. The owlets are always hungry; they will eat their own weight in food every night and more if they could get it. A case is on record where a half grown owl was given all the mice it could eat. It swallowed eight in rapid succession. The ninth followed all but the tail which for some time hung out of the bird's mouth. The rapid digestion of the Raptores is shown by the fact that in three hours the little glutton was ready for a second meal and swallowed four additional mice. If this is the performance of a single bird, the effect that a whole nestful of owls would have on the vermin of a community is self-evident.

Mrs. Irene G. Wheelock (1904) writes: "When the sun sinks behind the oak trees and the shadows creep over the valleys, the Barn Owl hurries to the nearest meadow or marsh land on a hunting trip. If it has young at home in the nest, its flight will be swift and noiseless, as it crosses the intervening fields at short intervals, carrying mice, gophers, and ground squirrels. Nine mice form a meal for the brood, and sixteen mice have been carried to the nest in twenty-five minutes, besides three gophers, a squirrel, and a good-sized rat."

The following items have been recorded in the food of the barn owl: Various mice and rats, nearly every available species, pocket gophers, shrews, bats, moles, muskrats, spotted skunk (*Spilogale*), and young rabbits; though birds form a small part of the food, a number of species have been found, such as various sparrows, blackbirds, grackles, starling, cowbird, Abert's towhee, bobolink, swallows, warblers, wrens, red-shafted flicker, sora and clapper rails, meadowlark, green heron, and blue jay; a few insects, such as grasshoppers, beetles, Jerusalem cricket, and katydid, as well as an occasional frog, should be added to the list.

Behavior.—The flight of the barn owl is light, graceful, rather swift at times, and always noiseless; its long, broad wings support its light body with ease and enable it to dash quickly on its prey. It is more strictly nocturnal than some other owls; when pressed for food to feed a hungry brood, it starts to hunt at twilight, but, at other seasons, I believe it prefers to hunt during the darker hours and perhaps all through the night; its food consists mainly of such small mammals as are active only at night. Its sense of hearing is exceedingly acute, enabling it to detect the sound caused by the slightest movement of its quarry; its eyes too are well adapted to night hunting; it seems bewildered in daylight and seems to dislike and shrink from any bright light. It is very inactive during the day, spending the daylight hours in a dark corner in some old or unfrequented building, in a cave, burrow, or hollow tree, in the thick foliage of some tree, or even among the scattered, dead leaves of a more open tree, where its motionless attitude and its concealing coloration make it inconspicuous. In such a situation it remains drowsily inactive all day, and often sleeps so soundly that it is not easily aroused, until the shadows of dusk awaken it into action again.

J. Harris Reed (1897) writes:

> During the fall and winter months I have found them roosting both singly and in colonies, depending on the size of their roosting places, and often occupying separate cavities of the same tree. An example of this may be found located in the woods at Glenolden, Delaware County, Pa., which has been a favorite roosting and nesting place for several years. * * *
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> On January 31, 1891, * * * I visited this tree and from the numerous holes in its branches counted fourteen Owls fly out during the evening. * * * Again on September 25, 1892, I paid the place a visit, but, arriving a little late in the evening, I saw only four Owls. * * * The Owls leave the roost very early in the evening, often a long time before sunset, departing singly, several minutes elapsing after the exit of one before the appearance of another, each circling around the tree several times before leaving, emitting a note similar to the clucking of a squirrel, probably a call note to their companions. This habit of leaving the roost before sunset, is more noticeable during the breeding season when the days are long and the nestlings require food, and this no doubt accounts for their being seen occasionally during cloudy days searching for food.

Barn owls are distinctly birds of the open country, rather than woodland birds, and they are less inclined than other owls to shun the haunts of man; they find their best food supplies in the open fields and meadows, and about the barns, granaries, and other buildings in villages, towns, and even cities. Their apparent familiarity with human beings is, doubtless, due to the fact that they are so strictly nocturnal in their habits and so retiring during the day that they are seldom disturbed or even seen by humans. Their silent coming and going is seldom observed; it is surprising how often a pair of these owls has long remained unnoticed in a thickly settled community; and it is well that it is so, for, otherwise, the long-established prejudice against all owls, or the craze to kill a curious bird, might lead some thoughtless man or boy to destroy one of their most useful friends.

Voice.—Potter and Gillespie (1925) record three different calls of the adult barn owl: "(1) A discordant scream expressing alarm. (2) A snapping of the bill expressing suspicion and alarm. (3) A flight call, resembling 'ick-ick-ick-ick', apparently signifying the bringing of food."

Grinnell and Storer (1924) say: "The notes of the Barn Owl are of two kinds: One is a single, loud, prolonged, rasping *sksch*, uttered only at long intervals; the other, a series of notes *click*, *click*, *click*, *click*, *click*, resembling in character the notes of a katydid, but delivered with diminishing emphasis and shortening intervals toward the end of the series. From the changing direction of the sounds, it is evident that the notes are uttered in flight as one bird closely follows another."

Bendire (1892) says: "Besides the peevish scream already mentioned, they utter at times a feeble querulous note like 'quäck-quäck,' or 'äck-äck,' sounding somewhat like the call of the Night Hawk (*Chordeiles virginianus*), frequently repeated, only not so loud."

Joseph W. Lippincott (1917) gives his impressions of the weird notes of the barn owl as follows:

> After listening night after night to the harsh screams, and even louder growling, rattling noise he can make, sounds which in the dark hours fairly make the shivers jump up and down one's spine, I can well imagine that woods could seem haunted and that, in the silent flopping flight of the big whitish bird, any superstitious person could see a ghost or almost any uncanny being of the visionary world. * * *
>
> It is one of the old Owls that makes the growling rattle which, reverberating among tree trunks, sounds almost like a menagerie let loose. The sound seems usually to be made while the bird is flying with, or to, its mate. When coming toward one it is truly terrifying, particularly if in some gloomy recess of a wood.

Enemies.—The barn owl has few enemies other than its arch enemy, man; it is deplorable that these interesting and useful birds are so often killed because of their supposed destruction of game birds or poultry, of which they are seldom guilty, or because they make interesting specimens to mount.

The great horned owl seems to be their chief natural enemy. These large, fierce, and powerful owls have been recorded several times as killing and devouring the gentle and weaker barn owl, which seems to be incapable of defending itself against such a formidable foe. Dawson (1923) says of the prairie falcon: "The Falcon is a heartless tyrant, and in this hour of his anxiety, he rejoices in a chance to vent his spite upon an innocent Barn Owl. Only luck can save the Owl. Some I have seen smashed in midair, and others merely bowled over, to rise wrathful but silent, and scramble into cover before a second bolt should fall."

Field marks.—The barn owl should be easily recognized anywhere and at any time by its unique shape and color. Forbush (1927) says: "If seen sitting, may be recognized by its pale colors, long legs and long, white, nearly heart-shaped face. If seen in flight, it may be told by buffy upper plumage, light or white under plumage and long wings; flies very lightly, often reeling from side to side."

Fall.—Throughout most of its range the barn owl is a permanent resident, but from the extreme northern portion it withdraws to some extent. It is also inclined to wander about more or less irregularly in fall.

Thomas Mason Earl (1934) writes: "A curious flight of Barn Owls was noted in 1917 just previous to the cold winter of 1917–1918. Two or three times a day for several weeks during the November hunting season Barn Owls were brought in for mounting. Other taxidermists had the same experience as I and I believe by a conservative estimate 200 Barn Owls were killed in Central Ohio by hunters, who encountered them everywhere."

Dr. Evermann (1882) says:

> This owl is resident in Southern California, being somewhat gregarious in Fall and Winter, during which seasons they frequent, in day time, the dense foliage of the Live Oaks which abound in the lesser canons and fringe the lower slopes of the foothills. On one occasion I drove more than fifty of these owls from a clump of oaks in Canada de Largo, and I have often seen from eight to twelve dozing quietly in one tree. The cross-beams under bridges form a favorite resort for them. Between Santa Paula and San Buenaventura, a distance of sixteen miles, there are bridges over as many as six *barancas*. * * *
>
> In passing over this road, I have often taken the trouble to look under these bridges, and I hardly ever failed to find from two to six Barn Owls sitting on the cross-timbers, or on projecting portions of the walls.

Alexander Sprunt, Jr. (1932) saw one come aboard a vessel 12 or 15 miles off the coast of North Carolina at 11 a. m. on November 1, 1931; as there was a strong offshore wind blowing at the time, the bird may have been blown away from the land, to which it was evidently struggling to return.

Winter.—Barn owls that linger too far north during severe winters have been known to perish, perhaps from the intense cold, but more likely from the lack of sufficient food to resist the low temperature. Dr. Paul L. Errington (1931) records such a case. In a quarry near Madison, Wis., on February 10, 1930, he found one of these owls lying dead, and a few days later another. He says:

> They were lying on the ground at the base of the quarry face, in the crevices of which face they had been accustomed to roost. A careful post-mortem disclosed that these birds had not met death from shooting or from direct mechanical injury of any sort. Though lean, they were not emaciated. Their alimentary

tracts were quite empty, except for a small amount of fecal matter in the intestine of one of them.

* * * The presence of these two in the quarry had been known for some months, and their pellet accumulations had been gathered from time to time for food habits study. It had been noted, as the winter had progressed, that the pellets had been becoming smaller, due presumably to the protection afforded mice and shrews by the snow. Many of the pellets last deposited contained the remains of but a single meadow mouse (*Microtus*), instead of the three to six small mammals making up a full size pellet. The owls were apparently unable to take advantage of the winter population of small birds; at least they had not done so.

Ivan R. Tomkins writes to me that in Georgia he has "often flushed this species from dense cedar trees in winter and sometimes from dry grass clumps."

DISTRIBUTION

Range.—Southern Canada, the United States, and Mexico. Allied races occur in many parts of the world.

The range of the barn owl extends **north** to southern British Columbia (Ladner); North Dakota (Gilby and Grand Forks); Minnesota (Fairmont and Waterville); Wisconsin (Madison and Dodge County); southern Michigan (Vicksburg, Ann Arbor, and South Lyon); southern Ontario (Chatham, Hamilton, Toronto, and Kingston); southern Vermont (Bennington); and Massachusetts (Wenham). **East** to Massachusetts (Wenham, Lynn, Dedham, and Chilmark); New York (Montauk, Jamaica, and Staten Island); New Jersey (Lawrenceville and Camden); Maryland (Easton); Virginia (Toano); South Carolina (Waverly Mills, Cooper River, Charleston, and St. Helena Island); Georgia (Savannah and Blackbeard Island); Florida (Fernandina, St. Augustine, Longwood, Cape Canaveral, and Key West); and Yucatan (Chichen-Itza). **South** to Yucatan (Chichen-Itza); Tabasco (Macuspana); Oaxaca (Tehuantepec); southern Sinaloa (Esquinapa); and Baja California (San Jose del Cabo). **West** to Baja California (San Juan del Cabo, Mira Flores, San Andres, and Todos Santos Island); California (San Diego, Escondido, San Onofre, Los Angeles, Santa Paula, Bakersfield, Shandon, Watsonville, Santa Cruz, San Francisco, Nicasio, and Ferndale); Oregon (Klamath Falls and Tillamook); Washington (Chinook, Point Chehalis, Puyallup, and Tacoma); and British Columbia (Ladner).

The range as above outlined includes the regions of more or less regular occurrence. Actual breeding, however, has been recorded only as far north as northern California (Ferndale); Nebraska (Omaha); Iowa (Sioux City and Laporte City); southern Michigan (Vicksburg and Ann Arbor); southern Ontario (Chatham); Connecticut (Winsted); and Massachusetts (Chilmark). The record from Ladner, British Columbia, is for a female in breeding condition, and it appears probable that other records in the northern part of the range may be of nesting birds.

Migration.—Records of the recovery of banded barn owls show that certain individuals make lengthy flights that appear to be more or less seasonal. These data are more numerous from the eastern part of the range and thus far the evidence pertains only to travels from breeding grounds to more southern points. In practically every case the record concerns a bird banded as a fledgling in its nest. For example, a bird banded in New Jersey at Westville on May 20, 1925, and another at Oradell on June 22, 1925, were recovered at Wilmington, N. C., on November 16, 1925, and at Savannah, Ga., on January 14, 1926, respectively. A third, also banded at Westville, N. J., on November 14, 1925, was retaken at Trappe, Md., on April 5, 1926. Two others banded in New Jersey were recovered at southern points, but in both cases the elapsed time was a year or more, as follows: One banded at Westville on June 4, 1926, was recaptured in Jasper County, S. C., in February 1928, and the other, banded at Riverton on June 13, 1929, was recovered at Berea, N. C., on November 15, 1930.

The files of the Biological Survey contain many other recovery records covering the details of flights of banded barn owls, as—from Wisconsin to Arkansas, from Illinois to Mississippi, from Ohio to Arkansas and Alabama, and from Pennsylvania to Georgia, the dates in some cases being strongly suggestive of regular seasonal migration. On the other hand, there also are records of birds that obviously remained in the north and were recovered in midwinter not far from the point of banding. About 20 cases are available of barn owls banded in California, all of which were recovered in the general vicinity where they were banded.

To sum up, it appears that in the eastern part of the country some young barn owls make extensive journeys southward that have some characteristics of true migration. This apparently is not general, however, and may be similar to the postbreeding season wanderings of certain herons, gulls, and other birds.

Casual records.—The only record of this species of British Columbia is the breeding female captured at Ladners Landing, near the mouth of the Fraser River, about April 7, 1909. In addition to a specimen obtained at Aylesbury, Saskatchewan, on May 5, 1924, there probably are one or two other sight records for that Province. There are two records for Manitoba, one taken at St. Annes on November 6, 1912, and another near Doleraine early in October 1927. There are several records for Ontario, the details of the most northern occurrences being a male taken at Toronto on September 7, 1899, and two specimens reported by Young in 1900 from the vicinity of Kingston.

A specimen was taken at Lyndon in northern Vermont on June 4, 1894, and there are three records for Maine, one shot at Biddeford on

October 4, 1923, a second caught alive in a garage in Portland on October 26, 1927, while the third was captured on Moshers Island, Cumberland County, about December 10, 1927.

Egg dates.—California: 100 records, January 17 to June 7; 50 records, March 9 to April 16, indicating the height of the season.

Pennsylvania, New Jersey, and Delaware: 40 records, February 22 to October 31; 20 records, April 9 to May 3; young, January 12.

South Carolina and Georgia: 14 records, March 17 to December 24; 7 records, March 30 to September 23.

Florida: One record, December 12.

Family STRIGIDAE: Typical Owls

ASIO WILSONIANUS (Lesson)

LONG-EARED OWL

PLATES 31–37

HABITS

As the American long-eared owl is now regarded as a species distinct from the European long-eared owl, it seems to me that the above name is misleading; the name American long-eared owl would be more appropriate and would indicate the distinction. Wilson and Audubon regarded the two as identical. They are evidently closely related and bear considerable resemblance to each other. Baird, Brewer, and Ridgway (1905) regarded the American bird as a variety, or subspecies, of the European bird and described the differences in the color patterns. The reader is also referred to Dr. H. C. Oberholser's (1922) discussion of this subject.

The American long-eared owl enjoys a wide distribution over nearly all the United States and the timbered regions of Canada, including the tree belts along the streams on the western plains and even on the deserts. It can hardly be classed as a bird of the deep forests, as it may be found wherever it can find the tree growth sufficiently dense to give it shelter for its nest and concealment during the day. I believe it prefers dense groves of coniferous trees, where these are to be found; in Massachusetts I have always found it in such places; but on the plains and prairies of the West, and on the arid plains and deserts of the Southwest, it seems equally at home in the deciduous timber belts around the lakes and along the streams, where it seems to be more abundant than in the East and, in some places, almost gregarious.

S. F. Rathbun writes to me that in eastern Washington "it appears partial to valleys of streams that have a growth of cottonwoods, alders, and similar trees, with thickets of various kinds, for many of the latter have a heavy growth of climbing vines and this owl seems to like the density of such places. In one such place, during the spring of 1933, we found it to be common. The birds appeared to confine themselves to a stretch of territory extending 6 or 7 miles along a small stream bordered with a mixed growth of the kind already mentioned, and within this area a number of pairs of the long-eared owl were nesting."

Probably this owl is much commoner than is generally supposed, especially in the East, where it finds such effective concealment in dense coniferous thickets. The long-eared owl is more strictly nocturnal in its habits than some of our other owls; it spends the day well hidden in the densest cover it can find and seldom moves about unless disturbed; for this reason it is seldom seen and may be common where its presence is not suspected. Its protective coloration and its effective hiding pose make it difficult to recognize and easy to overlook. It is more conspicuous and so seems more abundant in the deciduous trees of the West, especially in winter.

Nesting.—The long-eared owl is a rare breeder in eastern Massachusetts; many good ornithologists have never seen its nest; however, I have been fortunate enough to have seen seven nests of four different pairs of owls. My first nest was found on May 15, 1910, in Rehoboth. It was a small, insignificant nest about 20 feet up in a pitch pine in a patch of swampy, mixed woods, mostly white pines. It was apparently an old squirrel's nest, and I would have passed it by if I had not seen the bird fly from it; it was made of small sticks, rubbish, strips of inner bark, and pine needles and was lined with chips of outer bark and downy feathers of the owl; it measured 20 by 8 inches over all, and the inner cavity was 7 by 6 inches in diameter and 2 inches deep. It contained three eggs nearly ready to hatch.

The other nests were all in white pines. One, apparently an old hawk's nest, was about 40 feet up in a pine, surrounded by deciduous trees in a grove of tall, mixed woods. Two of the others were in rather open situations, where solitary pines, or small groups of pines, were scattered among a low growth of small deciduous trees and scrub oaks. These were, apparently, old crows' nests, well concealed in the thick tops of small pines, 25 and 35 feet from the ground. They were evidently successive nests of the same pair of owls; the first held five young on May 19, 1920, and the second contained five eggs, about one-quarter incubated, on April 20, 1921. This latter nest was made of coarse sticks and was lined with dead pine needles, strips of inner bark, and many owl feathers; it measured 24 inches in outside and 12 inches in inside diameter and was hollowed to a depth of 4 inches.

The other three nests were the successive nests of another pair of owls, in a large tract of dense white pine woods, where I had previously found Cooper's hawks nesting. These nests ranged from 30 to 40 feet above the ground, and two of them were in nests known to have been occupied by Cooper's hawks in previous years. In the first nest the hatching process was nearly completed on May 10, 1921. On May 24, 1925, all but one of the young had left the nest of that year. The following year, on May 26, the young of that year had all left the nest and were so well hidden that I could not find them, but the old owls were both very solicitous. I had looked at this nest on April 21, when the owl was undoubtedly incubating, but, as I saw no signs on the nest and could not drive the owl off by pounding the tree, I did not climb to it. I have doubtless passed by other occupied nests without knowing it, as this owl is not easily driven from its nest and there are seldom any feathers showing about the nest until after the young have hatched. I have never succeeded in locating any of these four pairs of owls since the above dates.

On June 2, 1905, while hunting along Bear Creek, near Crane Lake, Saskatchewan, we saw an old ferruginous roughleg's nest, about 14 feet up in solitary poplar among a lot of low brush near the creek (pl. 31). When I climbed up to it and looked over the edge, I was surprised to see a long-eared owl staring me in the face and less than 2 feet away; its feathers were all bristled up, its wings half spread, and its eyes blinking; it made a formidable appearance, hissing and snapping its beak. It was evidently as much surprised as I, but it settled down again on its five heavily incubated eggs as soon as I withdrew. The nest was a large one, 48 by 23 inches over all, and the inner cavity measured 10 by 9 inches; it was made of the usual large sticks and rubbish, and was lined with bunches of grass, pieces of dry cow dung, and a few feathers of the owl.

While I was hunting around Victorville, Calif., on the edge of the Mojave Desert, with Dr. Louis B. Bishop and Walcott Thompson, they showed me a small nesting colony of long-eared owls, where they had found at least four pairs of these owls with eggs or young two years before. The locality was an extensive tract of cottonwoods and willows along the Mojave River. The place was overrun with pack rats, which evidently furnished a convenient food supply for the owls. We flushed two of the owls, but not from nests. There were a lot of old nests in the woods, perhaps built by night herons or crows. One that I climbed to was evidently a feeding nest, as it had the remains of a pack rat in it. Another, which I could not climb to without irons, had considerable down on it and may have been the owls' nest.

In this connection Henry W. Henshaw (1875) says:

> It seems to be a habit with this species in the West to congregate together and form colonies, often made up of a large number of individuals. I have, however, noticed this to be most frequently the case in regions where timber was scarce, and doubtless this lack of places suited to the necessities of their nature, which requires them to pass the hours of daylight in some dark, secluded retreat, furnishes the reason for this apparent sociability. In Grass Valley, Utah, I thus found at least a dozen individuals together in a small grove of cedars, and nearly every tree

contained one of their nests, rudely made of coarse sticks, while some supported two or three. The birds were roosting in the low branches in the darkest portions of the clump, and they were generally so well concealed that I saw them only as they dashed hurriedly out when I was close upon their retreats.

Major Bendire (1892) writes:

> The Long-eared Owl rarely constructs a nest of its own; usually the last year's nest of a Crow is slightly repaired by being built up on the sides and lined with a little dry grass, a few dead leaves, and feathers; some of the latter may nearly always be seen hanging on the outside of the nest. Fully three-fourths of the nests found by me occupied by these Owls were those of the Crow. Only a very few were evidently built by the birds themselves. One such found near Camp Harney, Oregon, on April 4, 1877, was placed in a thick bush of dry willows about 10 feet from the ground. This was tolerably well built, composed externally of small sticks and sprigs of willows and aspens. Some of the latter had been peeled by beavers, which were common in the vicinity, and they were still green and pliable; these fresh looking sticks drew my attention to the nest, which I mistook for that of a Raven or Crow. The inner cup was about 5 inches deep and lined with dry grasses and feathers; it contained four fresh eggs. * * * On another occasion I found a pair of Long-eared owls occupying a cavity in an old cottonwood stump not over 12 feet high; a Red-shafted Flicker had that season excavated a burrow directly over that of the Owl's and the two entrance holes * * * were not more than 2 feet apart. The birds seemed to live in perfect harmony with each other.

Audubon (1840) also found a nest that was evidently made by the owls, "near the Juniata River in Pennsylvania, where it was composed of green twigs with the leaflets adhering, and lined with fresh grass and sheep wool, but without feathers."

Old nests of the black-billed magpie are often appropriated. A. D. DuBois, in his notes, thus describes such a nest that he found in Montana: "While exploring an almost impenetrable thicket, bordering the Teton River, I came upon an old magpie's nest, which would not have arrested my attention except for a number of downy feathers clinging to the outside of it. It was in a scrubby willow tree, about 15 feet from the ground. The field glass revealed no sign of life within, but when I made my way to the tree and gave it a rap with a stick an owl flew out from the farther side of the nest. She alighted on a branch a few feet away to take a brief look at me and then hastily disappeared in the brush. I climbed to the nest and could clearly see, through the openings in the old flattened canopy of magpie architecture, that it contained five white eggs. The old nest cup proper, constructed of mud, was for the most part intact, although somewhat dilapidated. It was rather flat and shallow. In it were a few coarse twigs and some gray feathers of the owl, forming a flat saucer-shaped bed upon which the eggs rested. The canopy, or roof, though not very thick, was sufficiently intact to enclose the nest completely, except for a large hole in one side, which the owl was using as an entrance, and a smaller hole opposite."

Grinnell and Storer (1924), writing of conditions in the Yosemite region, say: "In all cases the owls had preëmpted older nests of the Black-billed Magpie, a bird common in that vicinity. The owls begin to nest somewhat earlier than do the magpies, and hence gain possession of the last year's nests before the original builders have occasion to reclaim them. The magpies thus have to build anew. In almost every instance a newly constructed and occupied magpie's nest was found within 15 to 50 feet of an owl's nest."

Major Bendire (1892) says that J. W. Preston "took a fresh laid egg of the Long-eared Owl from a nest of Crow's eggs." J. A. Munro (1919) says: "On April 19, 1917, I found a female occupying a new crows' nest and sitting on one egg. Broken crow's eggs on the ground below the nest indicated that she had evicted the original owners. On April 30, the crows were again in possession and the nest contained four crow's eggs. The owl then laid four eggs in an old crow's nest, fifty yards from the first one."

Sidney E. Ekblaw (1919) found a nest in an apple tree in an old orchard and says: "About the nest small branches were very dense, thereby offering very good protection for a secluded nest. The nest itself was composed entirely of sticks with but a very few leaves for a lining. * * * In another crotch in the same tree we observed an old nest, identical in composition to the present one. As the long-eared owl has been recorded in this vicinity every year recently, doubtless the second nest was last year's."

Several instances have been recorded of the long-eared owl nesting on the ground, both in this country and in England. L. M. Terrill found one in the Laurentian Hills, northwest of Montreal, on June 4, 1928, and has sent me a photograph of the bird on its nest (pl. 36) and some elaborate notes on the subject. It was in a boggy, black spruce forest bordering a lake. "The nest was merely a shallow cavity, at the base of a black spruce sapling on the margin of a glade, well within the woods, lined with a very few twigs, flakes of bark and Labrador-tea leaves; any or all of this material could quite easily have fallen there. The glade was carpeted with sphagnum, with a sprinkling of such plants as *Ledum* and *Rhodora* and was somewhat littered with fallen trees, owing to lumbering in bygone years." Mr. Terrill thinks the owl was forced to nest on the ground because of the scarcity of suitable tree nests. He has records of more than 20 nests of this owl, and all the others were in old nests of crows or sharp-shinned hawks; all were in conifers in dense evergreen woods, mainly cedar swamps.

Mr. Rathbun tells me that if a set of eggs is taken the owl will lay a second set in about 20 days.

Eggs.—The long-eared owl lays three to eight eggs in a set, but four or five seems to be the commonest number. They are pure white and oval; the shell is smooth and rather glossy. The measurements of 103 eggs, in the United States National Museum, average 40 by 32.5 millimeters; the eggs showing the four extremes measure **43.5** by 33.5, 43 by **35, 37.5** by 31, and 38.5 by **30** millimeters.

Young.—The incubation period is generally considered to be about 21 days. An egg is laid about every other day, and since incubation begins when the first egg is laid the young hatch at similar intervals and show considerable variation in size. It does not seem to be known whether the male assists in incubation, but he is always close at hand, while the female is incubating, during the day at least, and responds quickly to her cries of distress. Probably he hunts for food at dusk and during the night and may feed his mate on the nest or relieve her to hunt for herself.

When between four and five weeks old the largest young birds begin to leave the nest, crawling out onto the surrounding branches. All leave the nest long before they can fly, climbing about or fluttering down to perch on any low branch or fallen tree. They are carefully guarded by both parents during this period, who rush to their defense and attempt to lure an intruder away by spectacular demonstrations. They are fed by their parents until they are at least eight or nine weeks old, have gained the full power of flight, and have learned to hunt for themselves. The family group keeps more or less together during summer and fall and perhaps during winter.

The calls of the young, described below by William Brewster (1925), are evidently their cries of distress that call their parents to their defense; at least they produced that result each time that he heard them. He writes:

> They were perched together on a fallen branch about five feet above the ground, to which they must have fallen or fluttered down not long before, from a nest that could be seen high in a pine directly overhead, for having wing-quills scarce more than one half grown they were incapable of level flight. When closely approached they behaved precisely like the young found in 1874 [crouching in a nest, see below under "Behavior"], and made essentially the same sounds although the blowing ones heard to-day were less suggestive of "snoring" than of the hissing or "spitting" of an angry house-cat, and the *crick-a-crick* calls seemed more like the chirping of a field-cricket than the squeaking of a wheelbarrow.

E. L. Sumner, Jr. (1929), in his studies of a brood of young long-eared owls, found that the egg tooth disappeared during the first week, but the young were very sluggish and inactive; even the oldest made no protest other than a feeble hiss, and all the rest were silent. Eleven days later, he says: "The largest three youngsters are quite aggressive, standing up with outspread wings inverted and every feather erect, which gives them a deceptively bulky appearance. They snap viciously at my outstretched finger, and sway from side to side—a trait not exhibited by any of the hawks—but are as yet perfectly harmless. With the exception of the oldest, they make no noise other than a snapping of the bill; this bird uttered a number of loud shrill prolonged squeaks, similar to one of the notes uttered by the adults."

When he visited the nest again, five days later, the young were from two to three weeks old; he writes:

> There are only three owls in the nest, and since it is highly improbable that the two largest birds could have learned to fly, it would seem that they have fallen out of the nest. This is all the more indicated by the surprising lack of care with which the remaining young move about in the nest when I approach—entirely unlike the behavior of hawks. They raise their wings, snap their bills, and without the slightest hesitation back right off the nest. Bird *c* saved itself only by clinging desperately to the under side, where it could not have remained long unaided. Bird *d* fell all the way to the ground, striking a large limb in its descent, and was unable to use its wings other than to break the force of the fall. This inability to remain in the nest until the power of flight is gained would appear to be a considerable liability to the species, especially because of the danger from predatory animals. * * *
>
> The remaining birds are more aggressive than ever. Like the Barn Owl, they throw themselves upon their backs and use their claws when hard pressed, and like these owls, they also run at the intruder of their own accord.

Plumages.—The young long-eared owl is hatched with eyes closed, but they open within a few days. It is sparsely clothed in short pure-white down on the main feather tracts only, with bare spaces between them; the facial disks are prominent and covered with white down. When huddled down in the nest the bird appears fully covered, but, as it moves about, the bare spaces are exposed; hence it is necessary for the parent to brood the young at this stage.

After a week or ten days the white down begins to be replaced by the soft, downy juvenal plumage. When about three weeks old the young bird is nearly half grown and the wing quills are partly out of their sheaths; the body is well covered with the long, soft, downy plumage; this is basally dusky on the head and neck, with grayish white tips, giving a hoary effect; on the under parts it is basally pale buff, terminally grayish white, and with two to four dusky bands on each feather; the downy plumage on the back is similar but with more buff and more distinct bands; the long, fluffy, grizzly down on the thighs is very prominent, the tail is still in sheaths, and the facial disks are conspicuously brownish black.

During the next two weeks the hoary down on the crown and nape is replaced by short, dusky feathers with broad, silvery-white tips; the wings and tail are growing, and the first winter plumage is replacing the downy plumage, first on the upper and then on the lower parts. At the age of six or seven weeks, the young owl is fully grown, the wings and tail are as in the adult, and nearly all the downy contour plumage has been molted; the last traces of immaturity to disappear are the hoary-tipped feathers of the crown and the downy plumage of the posterior under parts. In full first-winter plumage young birds are practically indistinguishable from adults.

Adults have a complete annual molt in the fall, from September to December. There is considerable individual variation, but, in the series I have examined, males average paler and with more white on the under parts than females. Dr. Oberholser (1922) says that there are "at least four color phases, these being a light and a dark ochraceous phase, and a light and a dark gray phase." These phases are none too well marked in a series of more than 70 specimens that I have examined, and they look more like individual variation, though there are more gray birds among the males and more ochraceous birds among the females.

Food.—The long-eared owl is unquestionably worthy of protection as one of our most beneficial birds of prey, for a very large proportion of its food, probably close to 80 or 90 percent on a seasonal average, consists of injurious rodents. Many of these owls have been shot as destroyers of game birds or rabbits, but, among hundreds of records, I can find only one record of a quail and two of ruffed grouse being killed, and very few records of young rabbits. There seems to be no record of domestic poultry being attacked.

Dr. A. K. Fisher's (1893b) summary states that "of 107 stomachs examined one contained a game bird [the quail referred to above]; 15 other birds; 84 mice; 5 other mammals (including one young rabbit); one insects and 15 were empty." In a lot of pellets collected near Washington, D. C., he found 176 skulls or parts of skulls, among which only 13 were of birds, and the remainder were of various mice and shrews. Dr. B. H. Warren (1890) "examined the stomachs of 23 long-eared owls and found that 22 of them had fed only on mice." Dr. Paul L. Errington's (1932c) pellet records for Wisconsin show that, during fall, winter, and early spring, mammals, mainly mice, make up 99 to 100 percent of the food; and during late spring and summer this percentage drops to between 87 and 92 percent, the percentage of birds running from 7 to 12 percent. His summary states: "Total vertebrate kills from pellets and stomachs (quantitative data) amount to 3,273; juvenile cottontail, 1; Norway rat, 3; meadow mouse, 2,732; deer mouse, 497; shrew, 14; small bird (mostly finches), 26." In two cases flocks of quail were wintering near where his owls were roosting, but he found no evidence that the owls ever molested the quail.

On the other hand, Dr. Charles W. Townsend (1918) had a collection of pellets examined, which he had found under a nest in June at Ipswich, Mass., and reported that the "owls had eaten some 13 different species of birds and 23 individuals; also 4 species of mammals and 25 individuals." This and Dr. Errington's summer records indicate that birds are taken in quantity only during the season when the owls have a brood of young to feed and when mice are not sufficiently abundant to fill their requirements. As additional evidence on this point, we have the report by F. M. Jones (1934) that a lot of pellets, collected early in summer under a nesting tree in Pennsylvania, contained the remains of 46 birds and 45 mammals; but he says that two young owls that he kept for several months in captivity "would invariably eat the mice first if given both mice and English Sparrows or Starlings, and should there be sufficient mice to satisfy their appetites, they would not eat the birds at all."

Dr. George M. Sutton (1926) has reported the killing of two ruffed grouse by a long-eared owl. It seems remarkable that this lightweight owl could attack and kill a bird so much heavier than itself, but the evidence seems convincing that the owl killed and partially ate the grouse.

Various species of mice make up the bulk of the long-eared owl's food; other mammals included are various rats, including the destructive Norway rat, shrews, moles, squirrels, chipmunks, pocket gophers, bats, and young rabbits. The list of birds is a long one, but in the aggregate it constitutes but a small part of the total food; it includes one quail, two ruffed grouse, and one mourning dove, as exceptionally large birds; the birds oftenest taken are the various species of sparrows, but red-winged blackbird, horned lark, meadowlark, cardinal, towhees, juncos, goldfinches, warblers, kinglets, thrushes, bluebirds, scarlet tanager, and brown thrasher have also been recorded in the food of this owl. Beetles and various other insects, frogs, and an occasional small snake have been eaten by it.

Grinnell and Storer (1924) write: "Hunting almost exclusively at night, this owl does not capture many birds. The Spurred Towhee here recorded as being captured is notable for being especially active at dusk, just when the Long-eared Owl begins its nightly forays. The Long-eared Owl, although roosting and nesting in dense thickets, does its foraging in the open, and small birds are not as available there, at least at night, as they are in the trees and bushes through which certain other species of owls, known to capture birds, are wont to hunt. The meadow mice and gophers are most active in the early hours of the night, when presumably this owl does most of its foraging."

Behavior.—The long-eared owl is normally so inactive and retiring during the daytime that we have learned very little about its behavior, except what we have seen of it when its nest or brood of young is disturbed. Here its behavior is quite variable and often exceedingly interesting and spectacular. I know of no bird that is bolder or more demonstrative in the defense of its young, or one that can threaten the intruder with more grotesque performances or more weird and varied cries. But the full performance is not always seen; it is seen at its best when there are young to be protected. At the first nest that I found, containing heavily incubated eggs, the owl merely flew around at a safe distance, snapping its bill and uttering a variety of weird notes. At the Saskatchewan nest the owl did not leave the nest at all but assumed her threatening attitude as I looked over the edge of the nest; she settled down again on her heavily incubated eggs when I withdrew.

Once I sat under a nest tree for some time, eating my lunch, without seeing any signs of life about the nest. When I climbed the tree the old owl flew off the nest, where she had been quietly brooding her young all the time. Her cries of distress soon brought her mate to the scene, and the performance began. Both parents were very demonstrative, flying about close at hand, alighting in the tree close to me, threatening to attack me, and indulging in a long line of owl profanity. One of the owls occasionally dropped to the ground, as if wounded, and fluttered along, crying piteously or mewing like a cat; by this ruse she succeeded in tolling my companion some distance away before she flew. This wounded-bird act, which I have never seen performed by any other bird of prey, was repeated several times on this and on other occasions.

Once, while I was standing in plain sight in a treetop near a nest, the female stood for a long time, perfectly still, a short distance away in the thick woods; meantime the male was perched near me, watching me and making frequent short flights over and around me, scolding and snapping his bill. Finally I crouched down more out of sight among some thick branches; the male soon flew to the nest and gave a low, squealing whistle, and the female returned to the nest at once, as if she had been assured that all was well.

W. Leon Dawson (1923) describes a clever ruse, employed to entice him away from a nest, as follows:

> The male parent had delivered himself of his quaint objurgations, and had retired from the scene in disgust. The female had caterwauled and cajoled and exploded and entreated by turns, all in vain. * * * All of a sudden the Owl left her perch, flew to some distance and pounced upon the ground, where she could not well be seen through the intervening foliage. Upon the instant of the pounce, arose the piercing cries of a creature in distress, and I, supposing that the bird in anger had fallen upon a harmless Flicker which I knew dwelt in that neck of the woods, scrambled down instanter and hurried forward. The prompt binoculars revealed neither Flicker nor mouse. There was nothing whatever in the Owl's talons. The victor and victim were one and the same, and I was the dupe. Yet so completely was the play carried out that the bird fluttered her wings and trod vigorously, with a rocking motion, as though sinking her claws deeply into a victim.

William Brewster (1925) writes:

> Half an hour after sunset this evening [June 12, 1874] I was hastening through woods of intermingling pitch pines and red cedars near Arlington Heights when a faint, intermittent *crick-a-crick*, not unlike the squeaking of an ungreased wheel-

> barrow, attracted my attention. It seemed to come from a dense growth of cedars in a hollow towards which I had taken only a few steps when the still air was rent by a dozen or more piercing shrieks, given in quick succession, and all alike save that each was a trifle less loud than the one immediately preceding it. Altogether they lasted almost half a minute and suggested the screams of a terror-stricken bird in the clutches of a Hawk, but were much louder and more startling. They constituted a fitting prelude to the spectacular appearance, only a second or two later, of their author, a large, female Long-eared Owl, who suddenly pitched down to the ground about thirty yards away and stood facing me with ruffled plumage and glaring yellow eyes. Her widespread wings were so held that the tips of the outermost primaries touched the carpet of pine needles at her feet and those of the innermost secondaries met over her back, the other quills radiating outward between them. Although, as I have said, she faced me, the *outer*, not inner, surfaces of both wings were shown in my direction. Owing to this singular disposition and inversion of all the flight-quills, they formed what appeared to be a large, erect, circular fan of evenly-spread feathers completely surrounding the head and body of the bird. Standing thus with threatening mien and menacing, swaying movements of the head, she looked like some impish, malformed creature half beside itself with rage.

This startling pose, so well described by Mr. Brewster, is often seen under various circumstances as a defense display. It is the pose assumed by the bird that I surprised on its nest in Saskatchewan. Major Bendire (1892) describes exactly the same pose that was assumed in surprised self defense by one of these owls that he came upon suddenly while it was killing a squirrel on the ground behind a log.

On rare occasions this owl will actually attack an intruder at its nest. Joseph Dixon had such an experience while trying to photograph some young owls. Grinnell and Storer (1924) say of it: "The owls usually gave little heed to the camera, save to glare at the lens as though the reflection seen there were another and intruding owl. One individual, thought to be a female, was more aggressive, and several times attacked the photographer openly. She would wait until Mr. Dixon put his head under the focussing cloth; then she would swoop down and strike his head. At first the bird used only her wings, but later, becoming emboldened, struck with her claws, and once inflicted slight wounds in his scalp."

Not the least interesting of the long-eared owl's tricks is its very effective hiding pose, which A. D. DuBois describes very well in his notes. He says: "I suddenly found myself gazing at a strange object in front of me, some 20 or 25 yards away. Soon I realized that it was an owl, standing upright and rigid, stretched vertically to its utmost, its girth contracted to an incredible degree. It seemed much more like a piece of broken tree branch than a living creature. It appeared perfectly cylindrical, very long, and small (I should say perhaps two and a half inches in diameter). Its 'horns' were erected to their full extent, were perfectly vertical and parallel, and in this position seemed very close together. This strange thing was entirely gray, of blackish and whitish tones in vertical streaks, resembling the rough gray bark of an old tree No color was visible except the yellow of the eyes, which gazed at me fixedly. It was a most remarkable protective attitude."

The flight of the long-eared owl is light, buoyant, and as noiseless as that of other owls. Its long wings and tail are more than ample for its light, slim body; consequently it sometimes seems to hover or flutter like a butterfly. Its gliding flight is swift at times, but it is seldom, if ever, called upon to capture birds on the wing. Generally its prey is silently approached and pounced upon. Although it hunts occasionally on dark days, its hunting is done mainly during the dusk of evening or early morning, or on moonlight nights. Whether it hunts to any great extent during the darkest hours of the night we do not know. The widely spread notion that owls cannot see in the daytime is, of course, an error. This, and all other owls that I am familiar with, can see just as well in daylight as other birds; and this one is especially expert in threading its way through the intricacies of the woods and thickets in which it takes its daylight naps.

Voice.—The long-eared owl is a versatile vocalist; its vocabulary is long and varied. The notes that I have heard have all been given in the vicinity of the nest; at other times this owl is a remarkably silent bird. The soft, hooting notes are recorded in my field notes as *quoo-quoo-quoo*, or as a more prolonged, single *quoo-oo-oo*, somewhat like the notes of the screech owl in quality. They are not harsh but rather musical and mellow. A still softer *whoof-whoof-whoof* is uttered at frequent intervals, presumably by the male, as an encouragement to his mate on the nest, or to the young. Grinnell and Storer (1924) say that "the hoot of the adult bird is low, mellow, and long-drawn-out, and bears a resemblance to the note of the band-tailed pigeon."

When much excited, both owls may fly about, snapping their bills vigorously and uttering loud notes of protest in three syllables, *wuck-wuck'-wuck*, or *wek-wek'-wek*, with a strong accent on the second syllable. At such times, I have heard also a low, squealing whistle, like the warning note of the ruffed grouse. During the highest pitch of excitement and anxiety, the owl drops to the ground with shrill cries of distress, loud piercing shrieks, flutters along the ground, as if badly wounded, and pours out a series of catlike mewing notes, *mie-e-ew*, or a more prolonged *mie-ee-u-u-u-ew*.

Others have heard similar notes as well as several different ones. Major Bendire (1892) says: "Except during the mating season it is rather a silent bird, and the few notes which I have heard them utter, when at ease and not molested, are low toned and rather pleasing than otherwise. One of these is a soft toned 'wu-hunk, wu-hunk', slowly and several times repeated, which really sounds much better than it looks in print; another is a low twittering, whistling note like 'dicky, dicky, dicky', quite different from anything usually expected from or attributed to the Owl family."

Mr. Dawson (1923) mentions "the regular note of disapproval, a sort of groaning execration used chiefly by the male, *Morach moraaaoow, werek werek wraaow, wreek wraaa*—all very 'flat' and very emphatic." Dr. Townsend's (1918) owl "constantly uttered low notes which suggested at times the barking of a small puppy, at times the notes *ud-hunk*." Dr. G. Clyde Fisher (1919) heard "a softly whistled *whee-you*, the two syllables slurred together. Although scarcely as long as the ordinary note of the Phœbe, in quality it suggested that of the Screech Owl—being, however, much shorter and more frequently uttered than the latter." Ernest T. Seton (1890) mentions "a strange shrieking, between the cry of a fox and a cat" and "a loud long cry like *on-il-il-il-il-il-loo*."

Alden H. Miller (1935) says that the hoot of the female is "four or five half tones higher" than that of the male. He says of the hoot of the male: "The pitch at first approximated that of a female Horned Owl. As the hoots were repeated the pitch was raised as much as five half tones. Even so, they were remarkably low for so small an Owl. Six to twenty hoots were given in a series and often only a few minutes elapsed between groups of hoots."

Field marks.—Being intermediate in size between the great horned and screech owls, the long-eared might be mistaken for either of these "eared" owls under certain circumstances, though it is relatively slenderer than either; in flight it is more wavering and uncertain, and it has relatively longer wings and tail. When perched its "ears" rise more nearly from the center of the head; it lacks the white throat of the great horned and is more longitudinally striped, less transversely barred, on the under parts. Its brown facial disks and its color pattern should distinguish it from the screech owls when perching at short range. As its "ears" do not show in flight, and sometimes not when perched, it might be confused with the short-eared owl, which it resembles in size and manner of flight, but it is more darkly colored, grayer, less buffy, and differently marked; neither of these owls is likely to be seen in the normal habitat of the other. E. S. Cameron (1907) says that "when this owl is in flight, a brown spot shows conspicuously on the buff lining of the wings underneath the primary bases."

Enemies.—Owls have few enemies except man; unfortunately they are usually shot on sight, because they are big and are picturesque as mounted specimens, or because they are supposed to destroy game and domestic poultry; this is a rank injustice to this beneficial mouser. Crows, jays, grackles, and many other birds habitually pester this and other owls, but they do no real harm to them. L. M. Terrill says in his notes that a pair of pigeon hawks had a nest within 150 yards of his long-eared owl's ground nest, and that "whenever the owl flushed from the nest one of the pigeon hawks swooped to attack it and drive it away. This happened almost invariably."

Winter.—Edward H. Forbush (1927) remarks:

> There seems to be a general belief that owls do not migrate, but with this species as well as some others that range far to the north, there is a regular southward movement from the most northern part of the range, a general migration which is evident also for a greater or less distance to the southward of their usual breeding range. Therefore, in spring and autumn Long-eared Owls are more numerous in New England than at any other season. Mr. H. H. Bailey says that large numbers come into Florida from farther north to spend the winter there, the time of their arrival depending much upon weather conditions in the north, but that many arrive by December and depart northward in March.

William Jay (1923) found a large colony of long-eared owls "wintering in a dense growth of pines and other coniferous trees growing along the Skippack Creek at Evansburg, Pa. No less than fifty of these birds were congregated in this grove. I was working my way slowly through the trees, when I came upon nine of these Owls at close range. As I did not wish to disturb them I backed slowly away, but right in to the main colony where I saw five or six Owls on every tree around me."

Dr. Alvin R. Cahn and J. T. Kemp (1930) found a colony of seven of these owls wintering "in an evergreen in the heart of the residence district of the city of Urbana," Ill. The numbers varied from four to seven, the latter number being counted on 44 occasions. The birds were first noted on November 8, 1926, and they remained until the following April 2; they returned to the same tree on October 21, 1927, and left on March 16 next. These may have been family parties.

Major Bendire (1892), on February 23, 1872, "saw about fifteen of these birds sitting close together on a small mesquite tree in a dense thicket in the Rillitto Creek bottom, near Tucson, Arizona." E. S. Cameron (1907), referring to Montana, says that "in fall and winter these owls occupy cavities in high cut banks of the badlands; Messrs. Archdale found a Long-eared Owl frozen to death in a badland hole."

The foregoing accounts, and numerous others, show that the long-eared owl migrates southward to some extent in fall and spends the winter almost anywhere that it can find suitable cover between the northern and southern borders of the United States. They also show that the species is decidedly gregarious at this season and indicate the probability that the young remain with their parents during their first winter.

DISTRIBUTION

Range.—Temperate zones of North America.

Breeding range.—The breeding range of the long-eared owl extends **north** to Mackenzie (Fort Simpson and Fort Providence); Saskatchewan (probably Fond du Lac, Prince Albert, and Qu'Appelle); southern Manitoba (Oak Lake, Carberry, Portage la Prairie, and Shoal Lake); Minnesota (probably Browns Valley and Elk River); Wisconsin (Marshfield, Kelleybrook, and West De Pere); Michigan (Munuskong State Park, Brant, and Detroit); southern Ontario (Lucknow, Coldstream, Toronto, and Kingston); southern Quebec (Quebec); New Brunswick (Woodstock); and Nova Scotia (Kentville and probably Halifax). **East** to Nova Scotia (probably Halifax); southeastern New Brunswick (Grand Manan); Maine (Bucksport and Warren); New Hampshire (Franklin Falls); Massachusetts (Ipswich and Taunton); Connecticut (Northford); Long Island (Lake Grove and Flushing); New Jersey (Summit and Penns Grove); Maryland (Baltimore and Rockville); and the District of Columbia (Washington). **South** to the District of Columbia (Washington); southern Pennsylvania (Hanover, Carlisle, probably rarely State College, and Du Bois); Ohio (Uhrichsville, Steubenville, and Toboso); northern Indiana (Fort Wayne and Cedar Lake); Illinois (Philo, Odin, and Roadhouse); Missouri (Courtney and Independence); Kansas (Topeka, Manhattan, and Ellis); New Mexico (Santa Fe); probably northern Arizona (San Francisco Mountain); and southern California (San Diego). **West** to California (San Diego, Escondido, Santa Catalina Island, Los Angeles, Santa Paula, probably Tulare Lake, Paicines, Alameda, Novato, Middle Lake, and Goose Lake); Oregon (Fort Klamath, Haycreek, and Sheridan); Washington (Bumping Lake); British Columbia (Lulu Island and Okanagan); and western Mackenzie (Fort Simpson).

Winter range.—In winter the long-eared owl is found **north** to British Columbia (Okanagan); Alberta (Stony Plain, Edmonton, and Provost); southeastern South Dakota (Vermillion and Sioux Falls); southern Minnesota (Hastings); southern Wisconsin (Madison); southern Michigan (Ann Arbor, Plymouth, and Detroit); southern Ontario (Plover Mills); New York (Lockport); and Massachusetts (Boston). **East** to Massachusetts (Boston and North Truro); Rhode Island (Newport); New York (Orient); New Jersey (Summit, Plainfield, and Five-mile Beach); Maryland (Laurel); the District of Columbia (Washington); North Carolina (Raleigh); central Alabama (Greensboro); and rarely Florida (Cape Florida and Cape Sable). **South** to rarely Florida (Cape Sable); rarely Louisiana (Abbeville); Texas (Houston and Brownsville); Durango (Las Bocas); Sonora (Tiburon Island); and Baja California (Rosario). **West** to Baja California (Rosario); California (Escondido, Victorville, and Willows); western Oregon (Corvallis); Washington (Yakima); and British Columbia (Okanagan).

Spring migration.—While there is no question that the long-eared owl performs regular migrations, there is little definite information available. Actual arrival and departure dates are apparently influenced as much by weather conditions and available food as by response to the migratory impulse.

Early dates of spring arrival nortb of the regular winter range are: Vermont—Rutland, March 3. Quebec—Montreal, April 17. New Brunswick—Scotch Lake, April 12. North Dakota—Rice Lake, April 9; Wahpeton, April 13. Manitoba—Treesbank, March 28; Margaret, April 1; Aweme, April 4. Saskatchewan—Indian Head, April 13; Osler, April 18.

Fall migration.—Late dates of fall departure from the regions north of the regular winter range, are: Saskatchewan—Indian Head, October 20. Manitoba—Margaret, October 20; Aweme, October 31; Treesbank, November 2. North Dakota—Argusville, November 18; Marstonmoor, November 18. Ontario—Ottawa, November 1. Nova Scotia—Halifax, October 1. Quebec—Montreal, October 22. Vermont—Rutland, October 24.

Data are too few to throw much light upon the times of arrival and departure in regions south of the breeding range, but in general these owls may be expected in such areas during the latter part of November and December and they will remain until late February and March.

The extent of the travels that may be made by long-eared owls is graphically illustrated by the flights of two individuals marked with numbered bands. One of these, banded at Rosebud, Alberta, on July 4, 1933, was shot at Layton, Utah, on February 2, 1935. The other, banded at Escondido, Calif., on April 22, 1934, was recaptured at Corbeil, Ontario, on October 9, 1934. This last record is one of the most remarkable banding records thus far obtained. It has, however, been thoroughly checked for accuracy.

Casual records.—A specimen was taken on the Taku River, Alaska, on September 26, 1909; three were collected in May 1877 or 1878 at Godbout, Quebec; and according to Preble (1902), it was found at Fort Severn, Manitoba, by Hutchins. One was seen at Oakley Depot, S. C., on January 16, 1917, while Wayne (1910) refers to two specimens collected in this State at Mount Pleasant, on March 16, 1896, and another at the same place on January 16, 1906. He refers also to another taken in Edgefield County, S. C., during the winter of 1905. Three were seen and one was collected on San Clemente Island, Calif., in December 1908.

Egg dates.—California: 58 records, March 1 to May 23; 29 records, March 17 to April 9, indicating the height of the season.

Southern Canada: 21 records, April 12 to June 5; 12 records, May 9 to 19.

New York and New England: 13 records, March 31 to May 31; 7 records, April 19 to May 15.

Pennsylvania and New Jersey: 29 records, March 14 to May 30; 15 records, March 29 to April 11.

Indiana, Illinois, and Iowa: 8 records, March 20 to April 28.

ASIO FLAMMEUS FLAMMEUS (Pontoppidan)

SHORT-EARED OWL

PLATES 38-40

HABITS

CONTRIBUTED BY CHARLES WENDELL TOWNSEND

The short-eared owl is one of the most cosmopolitan of birds, as it is found in every continent except Australia. In its habits it differs from most owls in preferring open plains, marshes, and sand dunes to thick forests, where it is almost never seen, and in the fact that it frequently hunts by day. Although it sometimes takes small birds, its feeding habits in general are of great value to man, for its favorite food consists of rodents. When field mice or voles increase so as to become veritable plagues, various owls, especially of this species, have been known to congregate in the infested region and to have done great service in destroying the pests. There are several such records in various counties in England extending back to the sixteenth century. Such a plague of mice is described by Hudson (1892) as occurring in South America in 1872-73, when short-eared owls were most important agents in stopping the plague. Notwithstanding their proved value, ignorant and thoughtless gunners continue to shoot these beneficial birds, and their numbers are diminishing.

Courtship.—The remarkable courtship flight and song of this bird have been well described by A. D. DuBois (1924), who not only made observations on the song at night, but on both the song and flight by day. The song consisted of a series of toots "repeated fifteen to twenty times, at the rate of four toots per second, in a low-pitched monotone." The sound seemed

> to come from all directions. Finally, upon gazing upward, I discovered the owl directly overhead, and for a time was able to watch him, with the field-glass, in the fading light. He was flying at a great elevation; so great in fact that it was difficult to see him at all without the aid of the field-glass. For the most part his flight was with slow, silent flapping wings, although he sometimes soared. His course led in easy curves which kept him in the same general locality. His song, on this occasion, was made up of 16 to 18 toots. Now and then he made a short slanting dive which terminated with an upward swoop. The dive was accompanied by a peculiar fluttering noise * * * a sound as might be produced by a fluttering small bird imprisoned in a box, or by the flutter of a small flag in a very strong wind.

Later, DuBois observed the flight in full sunlight and was able to solve the mystery of the "fluttering flag." "When the owl began the short dive he brought his wings together beneath him, stretching them back posteriorly and striking them rapidly together with short clapping strokes. The dive ended simultaneously with the clapping, when the bird spread his wings, abruptly and noiselessly turning his course upward with a swoop. The clapping was clearly visible with the field-glass and the fluttering sound produced by it was distinctly audible. He seemed to be applauding his own aërial performance." Mr. DuBois observed this flight song during four years, on the Great Plains in Montana between March 17 and August 28. In the later dates the young are already partly grown. On one occasion when he had examined a nest of four young and had seated himself at a distance, one parent disappeared, "the other flew and soared in circles above me, gradually climbing until it was at a great height. During the time that I watched, he twice indulged in wing-clapping. Having thus spiraled upward above me to his maximum height, he shifted his center of flight to a point more nearly over the nest, at the same time reducing his elevation."

Francis Harper writes that he observed the courtship flight of this owl at Gardiners Island, N. Y., in 1911 and thus describes it: "Late in the afternoon of June 14 I noticed one of the owls high up in the air, flying with exceptionally slow and somewhat jerky wing strokes at the rate of 150 a minute and making scarcely any headway. There seemed to be almost a perceptible pause of the wings as they reached their highest point, before beginning the downward stroke. Now and then the bird would swoop downward, meanwhile striking its long wings beneath its body, perhaps 8 or 12 times in the space of a second or two. It was a remarkable act, quite unlike anything known to me among other birds. The owl kept more or less over a particular part of the pasture and was probably 200, or even 300, feet in the air at times."

Edward A. Preble (1908) reports that several individuals of this species were seen on April 30, 1901, to the north of Edmonton, Alberta. "They were usually flying in pairs, and the males frequently swooped down toward their mates from a considerable height, holding their wings high above the back and uttering peculiar quavering cries."

Nesting.—The short-eared owl nests on the ground generally in a slight depression very sparsely lined with grasses and weed stalks and an occasional feather. Sometimes the nest seems to consist only of the flattened and dead vegetation of the spot chosen, or merely a slight hollow in bare sand. It may be entirely exposed to light in an open field or marsh or partly hidden by a clump of grasses or weeds. A. K. Fisher (1893b) says that "in exceptional cases it has been found in a clump of low bushes, or otherwise slightly elevated."

Coues (1874) quotes Dall who had found the short-eared owl "breeding in burrows on the island of Oomalashka; 'the hole is horizontal, and the inner end usually a little higher than the aperture; lined with dry grass and feathers.' The burrows were not over two feet deep, usually excavated in the side of a steep bank."

A few descriptions of individual nests will serve to show their character. A. D. DuBois (MS.) thus describes a nest in Montana: "The nest was situated on almost level ground—on the slight west slope of a knoll, amid the young growing wheat and the old last year's stubble. It was a shallow depression in the earth, sparingly lined with old wheat straws and the shredded husks of the stubble. There were a few soft feathers about the edges. A dried Canada thistle, remaining from the previous year, afforded slight protection on the east."

Charles A. Urner (1923) described a nest in a salt marsh near Elizabeth, N. J. The nest "was composed almost entirely of salt hay and about nine inches in diameter and an inch and a half to two inches thick. * * * The ground, immediately about the nest for a distance of four inches had apparently been almost cleared to furnish material and on one side the thick stubble still stood as if the matted dried grass had been broken off by the bird's bill. The presence of feathers (apparently owl's feathers) throughout the mass of the nest furnished additional evidence that this species of owl actually constructs its own nest."

J. Claire Wood (1907) thus describes a nest found in Michigan: "It was a mere platform of dead marsh grass half an inch thick and covering a spot of bare ground ten by eighteen inches. The long 'saw-grass' formed an arch over the nest, but there was an opening at the easterly end leading into an open space about two feet wide by four long—a sort of play and feeding grounds for the young." The nest and vicinity were kept clean of all castings, down, feathers, etc., that would tend to betray its existence. On the other hand, nests and their vicinity are often foul with droppings, feathers, and pellets.

Bendire (1892) describes two nests found in Idaho on the ground, "one in the center of a tall bunch of rye grass, the other by the side of one of these, and both were well hidden. * * * They were simply slight depressions not more than 2 inches deep, lined with pieces of dry grass and a few feathers from the birds."

That the short-eared owl may occasionally return to the same nesting site seems to have been shown by Urner (1923) who discovered directly under a new nest in 1922 "a more or less discolored white egg, one side slightly cracked as if from freezing, the dimensions corresponding to the egg of the short-eared owl. * * * Under the cracked egg could still be seen the outline of a well-rotted nest, presumably from the 1921 season."

Eggs.—[AUTHOR'S NOTE: The short-eared owl may lay anywhere from four to nine eggs, and rarely even more; but the commonest numbers are five, six, or seven. The eggs vary in shape from oval to elliptical-ovate. The shell is smooth, or very finely granulated, with very little, if any, gloss. The color is white, or very faintly creamy white. The measurements of 56 eggs, in the United States National Museum, average 39 by 31 millimeters; the eggs showing the four extremes measure **44** by 32.5, 40 by **33, 37.5** by 29.5, and 38.5 by **29** millimeters.]

Young.—The incubation period according to Bendire (1892) is about three weeks. F. L. Burns (1915) states it to be 21 days. Both sexes incubate and take care of the young. According to Urner (1923) the young fly in from 31 to 36 days after being hatched and remain in the vicinity of the nest for six weeks, although they stray from it and hide in the surrounding grass long before they can fly, sometimes as early as two weeks from hatching. Owing to their protective coloration, they are found with difficulty in the grass, and as they stretch out motionless on the ground this difficulty is increased. When aroused they turn on the back and fight. Mabel Densmore (1924) describes the actions of a young bird full grown but unable to fly that she discovered, "a bundle of feathers, dumped down in the short prairie grass, with no semblance to a bird except the eyes." While the parents flew excitedly around, the young continued to "play possum" and could be moved about and handled freely without showing a sign of life except in its eyes.

Nearly all the young of short-eared owls found at or near the nest differ in size and in development of plumage. Aretas A. Saunders (1913) measured each of nine young of one pair and concluded that their ages ranged between 3 and 14 days. He also found that each owl at about the age of two weeks strayed from the nest, going farther and farther each day even to a distance of 100 or 150 yards. He was always able to find the young by the action of the parents in feigning injury nearby.

Urner (1923) concluded from his observations in the salt marshes of New Jersey that short-eared owls sometimes move their eggs or helpless young to escape unusually high tides, and it is probable that when the eggs are destroyed by high tides or prairie fires, a second set is laid.

Urner (1921) describes the "wounded bird" actions of a short-eared owl flushed from a nest of young in New Jersey: "The first bird flushed strove vainly by imitating injury and distress to draw me away, these exhibitions including sheer drops or tumbles from the air and flutterings and cries with wings outspread while on the ground. When not thus engaged the bird maintained a position directly over head facing the wind. The second adult when flushed from the nest, joined the vigil overhead." The wounded-bird act differs in intensity and may or may not be accompanied by calling. On one occasion the excited bird struck his hat twice. The same author (1923) has this to add: "An interesting performance occasionally seen when the nest is visited is a steep dive toward the ground by the adult, the outstretched wings being brought together under the body as the bird descends, the ends being clapped together rapidly, the sound being distinctly audible when the bird is within one hundred feet." This is an illustration of a use of part of the courtship performance by birds at moments of intense excitement, even when not connected with the amatory instinct.

Saunders (1913) describes the wounded-bird act as follows:

> The bird circles at a height of about fifty feet, then drops straight down close to the intruder until within two or three feet of the ground, then sails low over the grass and brush in the opposite direction from the nest until a hundred feet or more away when he lights on the ground facing the intruder, squealing as though in great pain, and with wings widespread and flapping. If followed he will wait till one gets within about twenty-five feet, then slowly and carefully folds his wings one at a time, rises and sails a little farther away and repeats the wing flapping and squealing. If one is not watching him when he first drops to the ground, he frequently calls attention to himself by flapping his wings against his sides or breast as he drops, producing a sudden loud and startling noise that is very surprising in a bird whose flight is ordinarily perfectly silent.

An amusing variation of the wounded-bird act is given by Kitchin (1919): "We were here treated to a most ridiculous performance by the male bird. While watching the female we suddenly heard an awful groaning and chuckling sound behind us. This was the male and he was mad clear through, darting back and forth and uttering these awful sounds. Finally, he could stand it no longer and literally dove into a bunch of high weeds, where he twisted and turned, and to watch the tops of the weeds one would think that nothing less than a death struggle was going on."

Plumages.—[AUTHOR'S NOTE: When first hatched the nestling is fairly well covered with rather short soft down, grayish white or buffy white above and nearly pure white below. Witherby's Handbook (1924) says: "Base of down dark brown along wing, at base of wing and on each side of mantle, forming dark lines or narrow patches."

This natal down is soon replaced by the secondary down, which appears simultaneously with the first downy plumage, very loose and soft in structure. A nestling about 6 inches long shows the first plumage appearing on the back, but the under parts are now covered with long, soft, "cinnamon-buff" down, tinged with grayish on the chest. A still larger nestling, about 10 inches long, is well feathered on the back with the first plumage, "Verona brown" to "bister", broadly tipped with "cinnamon-buff"; the wings have just started to grow, but the tail has not yet appeared; the long, soft, thick down of the under parts is "cinnamon-buff", suffused with dusky on the chest and throat; the facial disks are now brownish black. The first winter plumage, which is much like that of the adult, soon begins to appear through the downy plumage, and the latter is gradually molted while the wings and tail are growing. By September or October, or perhaps earlier in early hatched birds, the young bird is fully clothed in a firm plumage, which is practically adult.

Adults have a complete, annual molt between August and November. Witherby (1924) says that a molt of the body plumage occurs between January and March. Although the manuals do not mention it, I have noticed that adult males, perhaps the oldest birds, average much paler in color than the females. Some of the old males have an almost pure-white ground color on the belly, only faintly cream-white on the breast, and pure white on the tibiae and under tail coverts; in these birds the light edges above vary from "cream-buff" to white. On the other hand, the darkest females are colored "ochraceous-buff" to "warm buff" on these parts. These differences may be color phases or partially due to age or seasonal changes, but there seems to be an average sexual difference.

T. Russell Goddard (1935), while studying short-eared owls in England, discovered "that there were two distinct colour forms * * *—a brown form and a grey form. Of the six birds under observation during April and May three were brown and three were grey. They were paired in the following manner—two browns, two greys and a grey male paired with a brown female. The grey form was literally a cold grey without any warm brown about it at all. The feathers on the breast and tarsi, which in the brown form are a warm buff, were white in the grey form. The grey form of the Short-eared Owl was, in fact, quite as cold in colour as the extreme grey form of the tawny owl (*Strix aluco*)."]

Food.—The short-eared owl is the friend of man, and if he had been treated as he deserved and not shot on sight—as is man's stupid and cruel habit—the damage to our young orchards by mice, now so common, would be less. Rodents of various kinds, particularly meadow or field mice (*Microtus*), which do so much harm, are his favorite food. Dr. A. K. Fisher (1893b) reports the findings in the stomach of 101 short-eared owls as follows: "1 contained small birds; 77, mice; 7, other mammals; 7, insects, and 14 were empty." Of the mice, nearly all were meadow mice, a few white-footed, pine, and house mice. Six shrews, a cotton rat, a rabbit, and a pocket gopher were the other mammals listed. A grackle, a red-winged blackbird, 4 juncos, 11 sparrows of various species, and a robin were the bird victims.

Junius Henderson (1927) states that 75 percent of the food of this owl consists of mice and that it is more insectivorous than any other of our owls except the burrowing and perhaps the screech owl. One stomach contained 50 grasshoppers, one 18 May beetles, and one 13 cutworms. Of 254 stomachs examined, 15 percent contained birds. Cahn and Kemp (1930) examined 137 pellets of this owl and found the remains of 110 small mammals of five species and of three birds; two were meadowlarks and one a vesper sparrow.

Errington (1932c) from a study of pellets found the remains of 68 meadow mice, 115 deer mice, 1 snow bunting, and 1 meadowlark, and he says that this owl "seemed to show a distinct preference for small mammalian over small avian prey, even at times when small birds may have actually far outnumbered the rodents which were depended on for food."

Although rodents are the chief of this bird's diet there are occasional exceptions generally under unusual circumstances. Thus William Brewster (1879) found at Muskegat a small colony of short-eared owls that preyed on the nesting terns. At least a hundred had been killed and eaten, judged from the remains, and in each case the breast had been picked clean, but nothing but the breast had been eaten. At this island in June 1913, I found about 50 terns treated in this way by the short-eared owls. Nothing but the breasts and entrails had been eaten. The remains of the terns were found singly or in groups of three to six. Laurence M. Huey (1926b) reports an entire California black rail, swallowed in two pieces, in the stomach of a short-eared owl. He also reports in detail the contents of two pellets of this bird from a salt marsh near San Diego. In one of these were the skulls and other bones of two species of bats and the remains of a meadow mouse, of a Belding's marsh sparrow, and of a Savannah sparrow. The other contained the remains of the two species of bats, of an American pipit, and unidentified bird bones, feathers, and mouse hair. Pierce Brodkorb (1928) reports two juncos and two swamp sparrows found in one stomach and in another a snow bunting. Urner (1923) found a nest of this owl "literally carpeted with the feathers of small birds. At its edge was a freshly-killed Sharp-tailed Sparrow. I found no remains of mice and only one small pellet composed apparently of feathers." Ludwig Kumlien (1899) found a nest in Wisconsin made up of feathers and matted grass in which he found the remains of more than 40 species of birds varying in size from a kinglet to a meadowlark and, curiously enough, no trace of any mammal. He took the three young, about two weeks old, to his house and found they required 12 to 15 English sparrows daily to satisfy them.

J. A. Munro (1918) records the following:

> Between September 28 and October 16, 1909, I spent several days collecting in a small dry meadow, on the south shore of Ashbridge's Marsh [Toronto]. Short-eared Owls were more numerous than usual and were apparently feeding entirely on small birds. Four stomachs examined contained feathers and bird bones exclusively. In a small tract of dry grassy meadow, roughly estimated at fifty acres, I found feathers of the following species marking the spot where

they had been eaten by owls; one Hermit Thrush, one Sora, three Yellow-bellied Sapsuckers, one Slate-colored Junco, one White-crowned Sparrow, and eighteen others, of which there were not enough feathers left to identify the species.

During April and the early part of May of the following spring, the owls were again plentiful, preying on the hosts of migrants, that rested along the sandbar, after crossing Lake Ontario. With one exception all the castings contained the bones and feathers of small birds. This meadow was swarming with voles, but only one pellet, of the many examined was composed of the fur and bones of voles.

Ivan R. Tomkins sums up and draws interesting conclusions on the findings of pellets collected near Savannah, Ga., and examined by the Biological Survey. He says: "The 50 pellets collected during January and February contained remains of 34 birds, of 14 identifiable species, and 54 mammals, of two or more species. The 18 pellets collected in the same places during late February and March contained remains of 4 birds and 45 house mice. Several points of interest are: The unusual proportion of birds in the first lot (there was also an abundance of birds during the last period, but mammals seem to be the choice food then) and the presence of such species as fox and white-throated sparrows, woodpecker, flicker, and kinglets, all species preferring thickets or woods, coupled with the absence of Savannah and song sparrows, these last very abundant in the precise locality most inhabited by the house mice and rats."

Behavior.—Owing to its diurnal habits and its love of open places the short-eared owl is one of the owls most frequently seen by man. It avoids forested regions, although in its extensive migrations it passes over them as well as over the sea and has therefore been observed on rare occasions in the midst of a forest or many miles at sea. William A. Bryan (1903) reported one that was seen to circle down from a great height and alight on one of the yards of a vessel bound for the Hawaiian Islands and 680 miles from Puget Sound. This was in October 1902. In the same month, in 1900, another was observed some 500 miles from these oceanic islands.

In hunting its prey the short-eared owl adopts the same habits as the harrier, or marsh hawk, and may often be seen circling close to the ground or flying over it, sometimes gliding, sometimes flapping and dropping down on its victims with down-stretched feet. Occasionally it sustains itself by hovering over one spot before it pounces. When the wind is blowing strongly, it takes advantage of the upcurrents over rolling country and especially among sand dunes, where it may be seen gliding into the wind with great speed and skill. At times it may be seen sailing lightly about at a height of 20 or even 30 yards, turning its round head now this way now that and closely scanning the ground. On some occasions it alights on the ground and watches for its rodent prey to appear. R. H. Lawrence (1892) reports that in the salt marshes near South Bend, Wash., "they sat much on the edges of many deep sloughs waiting for a species of rat. I found many evidences of their success in getting them." There is a cut in the Argentine ornithological journal, El Hornero, of one of these owls sitting on the ground with its feet on either side of a mouse hole, ready to clasp its victim should it emerge from the ground.

The short-eared owl may often be found perched motionless on fence posts or stubs of trees, in tufts of grass, or even on the bare ground. Here among dead grass, especially in sand dunes, it is very difficult to see. On one occasion after being deceived several times by owls that resembled stumps or small posts flecked with lichen or sand or snow, I was willing to consider a certain obvious stump to be an owl, but after changing my mind and deciding it was not one, the "stump" opened its wings and flew away! In such situations, the owl remaining perfectly motionless until the fatal moment, doubtless snaps up many a wandering mouse.

Although this owl hunts freely by day it hunts more freely at dusk and in the early dawn, and it also hunts at night. It sleeps at intervals both day or night usually concealed in tufts of grass and sometimes in thick evergreens, in the latter no doubt in storms. In walking over an upland pasture or marsh, or among sand dunes, one may suddenly flush a short-eared owl, disturbed from its nap or watching for a victim, or feasting on one already killed. Once I flushed one in dunes that, judging from the many feathers about, had been eating a robin. At such times the owl flies away, sails gracefully about, and often alights again at no great distance.

Charles A. Urner (1923) reports the following interesting behavior of a short-eared owl. After he had answered the call of a yellowlegs—

> Suddenly a Short-eared Owl came out of the growing darkness and dove at my straw hat. He missed it by inches. I whistled the Yellow-legs call again. He turned and dove at me the second time with no end of determination in his manner. Six times I whistled and six times he turned and swooped at me, finally alighting on a mud pile nearby to look the situation over more carefully. I stood in the open marsh with no protection. Had I whistled in the daylight he would have shown no interest. Apparently he did not recognize me as a human in the dusk. He struck on the impulse of his ears—not his eyes. And apparently he knew the taste of Yellow-legs.

Short-eared owls may be seen pursuing crows and even marsh hawks. Eugene Bicknell (1919) watched a pair of owls repeatedly attacking a single crow. "The Crow, perhaps to escape the Owls, perhaps intent on depredation of their nest, several times swept down to the ground about a certain spot, the Owls pursuing it or awaiting its return into the air when attack and counter-attack were renewed. The following year at the same place a pair were observed on February 22, attacking a Marsh Hawk."

In the following incident the tables were turned against the short-eared owl as reported by H. P. Attwater (1892). He was attracted by the cries of two red-shouldered hawks and, walking toward them, flushed three or four short-eared owls. "One in particular mounted to a great height, followed by the Hawks, and in the fierce attack which followed it held its own bravely for some time till they finally appeared tired of the fight and flew away."

This owl sometimes attacks large birds, possibly only in a spirit of mischief or play and not with any intention of killing them. Thus William Brewster (1925) reports one swooping at black ducks in a pond, and another soaring in circles above a soaring great blue heron and swooping at and striking it repeatedly on the back. For several minutes this performance went on, the heron circling and "croaking incessantly and, when struck by the Owl, squalling so lustily that it might have been heard half a mile away. Quite evidently it was badly frightened. The Owl, without doubt, was merely amusing himself."

Clarence S. Jung (1930) describes an aerial fight between a short-eared owl and a marsh hawk. "The Owl pursued the Hawk, flying above the retreating bird. Hovering some ten feet above the Hawk, the Owl would suddenly swoop down in a fierce attack. In the same instant the Hawk would half turn like a tumbler pigeon, in such a manner so as to strike the Owl with its talons as that bird passed. The dexterity and maneuver of the two birds was amazing. The attack was repeated seven or eight times. It is to be supposed that the Hawk disturbed the Owl's nest and was being driven away."

Voice.—During migrations and winter the short-eared owl is one of the most silent of birds, but on the breeding grounds especially when the young are about it is far from silent. The courtship song, both vocal and instrumental, has already been described above. Charles A. Urner (1923) describes five distinct calls of the short-eared owl. The first, high pitched and rasping, resembles the barking of a small animal. It is usually uttered in triplets and might be written *wak, wak, wak* or *yak, yak, yak*, but there may be eight or more rapid repetitions. The second is uttered singly and is more prolonged, *w-a-a-a-k*. The third, Mr. Urner writes as *wä'u* or even *wow*. The fourth suggests sawing or filing, a rather long drawn rasping note, while the fifth is a clear whistle-like squeal. Like most owls, young and adults may snap their bills and hiss. Saunders (1913) states that the voice of the female is "higher pitched, more squeaky and less harsh than the male." The cries of the owls, especially when their young are disturbed, have been likened to the "squealing of young pigs" and to "the barking of a young puppy" (W. W. Worthington, 1893). Lawrence (1892) says "this owl has a shrill barking call like the '*Ki-yi*' of a little dog." Mabel Densmore (1924) describes the notes of a pair of birds signaling to their nearly fully grown young as "subdued noise, muffled and short, half sneeze, half bark" and that of the young like the sound of "escaping steam turned on and off suddenly but lasting about three seconds."

Field marks.—As the short-eared owl skims the marshes and fields like a harrier, it might be mistaken for a marsh hawk, but the much shorter tail and the large round owl head, as well as the absence of white on the rump, make its identification easy. The small "horns" or "ear-tufts" can not be seen in flight and only rarely when the bird is perched. They are so short that they are concealed when the bird is alarmed or excited and erects the feathers of the head. The light under parts of the bird and the small oblong black patches at the base of the primaries seen from below are good field marks. It is about the size of the broad-winged hawk from which it is at once distinguished by its round head. A patch of creamy brown on the upper surface of the open wing is also distinctive.

Winter.—As small rodents are the favorite food of this owl, it generally migrates south to grassy and weedy regions where there is little or no snow. In such favorable localities they sometimes collect in considerable numbers. Harris (1919) describes such gatherings in flocks of 8 to 50 in the prairies close to buildings in Kansas City, and Tyler (1913), in the Fresno district of California, estimated as many as 200 of these owls hunting over stubblefields at sunset one December afternoon.

Frank L. Farley contributes the following note: "In the fall of 1931, when engaged in threshing their grain, farmers in central Alberta noted an unprecedented number of mice in the fields. Later, when winter set in and threshing operations were halted on account of deep snow and extreme cold, it was discovered that the grain shocks in the fields were infested with the rodents, as many as a dozen of the destructive little animals having taken up their winter quarters under a single shock. In October and November, unusual numbers of short-eared owls were observed patrolling the fields, hunting for mice, and later their numbers were augmented by the arrival of thousands of northern-bred birds. On December 31, 1931, H. A. MacGregor and I drove 25 miles by automobile, south of Camrose through the Duhamel country, and saw 24 of these owls. All were hunting in, or adjacent to, fields of shocked grain. John W. Russell recorded in 16 days, between November 26, 1931, and February 5, 1932, 116 owls, this being at the rate of 7.25 a day. The number of mice that this vast army of owls destroyed must have reached enormous proportions, and the birds may have prevented what otherwise would have resulted in a serious plague. An invaluable service was rendered at a time of emergency, and at no cost whatever to the people."

The short-eared owl is an interesting and beneficial bird. May it long survive!

DISTRIBUTION

Range.—North America, Europe, and Asia.

Breeding range.—In North America the breeding range of the short-eared owl extends **north** to Alaska (St. Paul Island, Cape Prince of Wales, Cape Blossom, Kobuk River, Wainwright, Point Barrow, and Barter Island); Mackenzie ("50 miles below" Fort Anderson, Franklin Bay, and Bernard Harbor); northeastern Manitoba (Cape Eskimo); and rarely southeastern Baffin Island (Greater Kingwah and Kingnite Fiord). **East** to rarely southeastern Baffin Island (Kingnite Fiord); Labrador (Fort Chimo, Nachvak, Ramah, Okak, and Port Manvers); Quebec (Anticosti Island and Magdalen Islands); Nova Scotia (Kentville and Halifax); Massachusetts (Rehoboth, Chatham, Muskeget Island, and Nantucket Island); New York (Plum Island and Gardiners Island); and New Jersey (Barnegat Bay, Beach Haven, Canton, and Cape May). **South** to New Jersey (Cape May); northwestern New York (Brockport and Buffalo); northern Ohio (Pymatuning Bog, Cleveland, and Circleville); northern Indiana (Waterloo, Cedar Lake, and Lowell); southern Illinois (Odin); Missouri (Maple Lake and Kansas City); Kansas (Neosho Falls and Manhattan); probably northeastern Colorado (Sterling); Utah (Salt Lake County and Boulter); northern Nevada (Halleck, Paradise Valley, and Deep Hole); and California (probably Amedee and Los Banos). **West** to California (Los Banos and Palo Alto); Oregon (Klamath Lake, Bandon, Corvallis, and Salem); Washington (Olympia and Tacoma); British Columbia (Victoria and probably Kamloops); and Alaska (Mount McKinley, Popof Island, Unga Island, Amaknak Island, and St. Paul Island).

Various authors since 1848 have cited the short-eared owl as a breeding bird of Greenland, but the evidence appears to be entirely hearsay, which through frequent repetition has gained credence. Similarly, there appears to be no unquestioned record for Newfoundland.

Winter range.—Occasionally, individual short-eared owls will remain north in winter nearly to the limits of the breeding range but the normal extent of the range at this season seems to extend **north** to southern British Columbia (Victoria and Okanagan); east-central Washington (Spokane); Alberta (Camrose); Montana (Corvallis, Boseman, and Terry); South Dakota (La Creek, Forestburg, and Sioux Falls); Minnesota (Fort Snelling, St. Vincent, Marshall County, Pipestone County, and Roseau County); southern Wisconsin (Madison and Milwaukee); southern Michigan (Ann Arbor and Detroit); southern Ontario (London); northern Ohio (Cedar Point and Oberlin); New York (Lockport, Rochester, and Auburn); rarely Vermont (Clarendon and Bennington); and Massachusetts (Ipswich). **East** to Massachusetts (Ipswich, Nahant, and Marthas Vineyard); New York (Orient, College Point, and Staten Island); New Jersey (Camden); Maryland (Baltimore, Sandy Spring, and Dorchester County); North Carolina (Raleigh); South Carolina (Marion and Bulls Island); Georgia (Darien and the mouth of the Savannah River); and Florida (Amelia Island and Miami). **South** to Florida (Miami, Cape Sable, Passage Key, and Goose Creek); Alabama (Greensboro); Louisiana (New Orleans, Lobdell, and Cameron); Texas (Houston, Rockport, and Fort Brown); Tamaulipas (Matamoros); probably rarely Hidalgo (Tlalpam); and southern Baja California (Mira Flores, San Jose del Cabo, and Cape San Lucas). **West** to Baja California (Cape San Lucas and San Fernando); California (Salton Sea, Buena Park, Jamesan, Haywards, San Geronimo, Marysville, Willows, and Chico); Oregon (Fort Klamath, Rickreall, Tillamook, and Portland); Washington (Yakima, probably Nisqually Flats, and Seattle); and southern British Columbia (Victoria).

Spring migration.—Early dates of spring arrival north of the normal winter range are: Quebec—Kamouraska, April 10; Godbout, May 3. Ontario—Ottawa, March 26; Toronto, April 10. North Dakota—Keene, March 13; Westhope, March 27; Bismarck, April 2; Larimore, April 15. Manitoba—Treesbank, March 31; Margaret, April 5; Shoal Lake, April 30. Saskatchewan—Indian Head, April 6; Lake Johnstone, May 10. Alberta (winters rarely)—Flagstaff, March 30; Onoway, April 1; Veteran, April 4; Belvedere, April 14. Mackenzie—Fort Simpson, April 28; Fort Franklin, May 20. Alaska—Mount McKinley, April 30; Fort Yukon, May 7; Demarcation Point, May 12; Flat, May 15.

Fall migration.—Late dates of fall departure from the breeding grounds are: Alaska—Unalaska Island, October 5; Craig, October 18; St. Paul Island, November 8; Baranof Island, November 27. Yukon—Fortymile, October 10. Mackenzie—Arctic Red River, October 23. Alberta (winters rarely)—Alix, October 15; Glenevis, October 16. Saskatchewan—North Battleford, September 3. Manitoba—Treesbank, November 16. North Dakota—Keene, November 2; Jamestown, November 17. Ontario—Port Dover, November 5; Point Pelee, November 22; Ottawa, November 28. Labrador—Red Bay, September 13. Quebec—Montreal, October 31. Maine—Portland, November 14.

Casual records.—According to Reid (1884) four specimens were taken on Bermuda prior to 1884. Indians brought specimens to Salvin that they claimed had been taken "in the rough grass among scattered pines near the tree level on the Volcan de Agua", Guatemala. This remains the only Central American record for this species. One was shot between December 24 and 31, 1897, at Catalina Island, Calif., and the species also was recorded on the Farallon Islands, during the spring of 1885 and again in May 1887 (Bryant, 1888, p. 45).

Egg dates.—Alaska and Arctic Canada: 6 records, June 10 to 30.

Alberta and Manitoba: 9 records, May 5 to June 20.

Dakotas and Minnesota: 17 records, March 20 to June 12; 9 records, May 12 to 23, indicating the height of the season.

Illinois, Kansas, and Nebraska: 7 records, April 8 to May 17.

STRIX VARIA VARIA Barton

NORTHERN BARRED OWL

Plates 41–47

HABITS

In southern New England and southward, as well as through most of its habitat east of the Prairie States, the barred owl is our commonest large owl. I have had more experience with it than with any other owl. It is a forest-loving bird, living mainly in the deep, dark woods, heavily wooded swamps, gloomy hemlock forests, or thick growths of tall, dense pines, where it spends most of the day in the quiet seclusion of its shady retreats. In such resorts it is seldom disturbed, but when its haunts are invaded it is not caught napping; it often greets the intruder with its weird hooting notes and flies about quite actively, even in broad daylight. Much of its hunting is done in the open country and about the farms, and in fall and winter it occasionally ventures into the villages and even into cities in search of food.

Courtship.—The barred owl's courtship consists mainly of loud and spectacular vocal efforts, indulged in by both sexes. Many a time, late in winter or early in spring, I have listened to the weird love notes of these, the noisiest of owls. From the dark shadows of the hemlocks or pines they hoot again and again, answering each other with loud, vehement calls, strongly accented with a rhythmic swing and a wild, strenuous cadence of great carrying power.

Edward H. Forbush (1927) witnessed a performance which I have never seen; he writes:

> At one of my lonely wilderness camps in the month of March a pair of Barred Owls came to the trees over my campfire and made night hideous with their grotesque love-making, banishing sleep during the evening hours. Their courting antics, as imperfectly seen by moonlight and firelight, were ludicrous in the extreme. Perched in rather low branches over the fire they nodded and bowed with half-spread wings, and wobbled and twisted their heads from side to side, meantime uttering the most weird and uncouth sounds imaginable. Many of them were given with the full power of their lungs, without any regard to the sleepers, while others were soft and cooing and more expressive of the tender emotions; sounds resembling maniacal laughter and others like mere chuckles were interspersed here and there between loud *wha whas* and *hoo-hoó-aws*.

Nesting.—In the region where I hunt, in southeastern Massachusetts, the barred owl is decidedly our commonest large owl, but it is none too common at that. My notes, from 1891 to 1935, give the records of 38 nests examined; in 1924 I found the nests of three pairs, and during eight other years I found the nests of two pairs each year. The local distribution of the barred owl in this region coincides almost exactly with that of the red-shouldered hawk; I have always considered these two as complementary and friendly species; their haunts and their food are very similar; one hunts exclusively by day and the other largely by night or twilight in the same locality. They often use the same nests alternately and rarely even simultaneously; almost always there is a red-shouldered hawk's nest in the same patch of woods with the barred owl; once I found the occupied hawk's nest within 24 yards of the owl's nest.

In this region the barred owl shows a decided preference for heavy, white-pine woods; 21 of my nests have been in white pines, only 6 in deciduous woods, and the others in mixed woods of pines, oaks, and chestnuts. I believe that this owl prefers to nest in a hollow in a tree, where such a site is available; but suitable hollows are rather scarce and the owls are more often forced to appropriate an old nest of some other species. Of my 38 nests, 18 were in old nests of red-shouldered or Cooper's hawks, often in a nest of the previous year; in some few cases the hawk has used the nest again the following year; 15 nests were in hollow trees, and 5 were in what were apparently old squirrels' nests.

With the exception of the red-shouldered hawk and the osprey, the barred owl is the most constant in its attachment to its chosen nesting site of any of our local hawks and owls. Brief histories of some of our local pairs, or their successors, will illustrate this. The history of one of our old pairs began in 1896, when Herbert K. Job discovered the nest in a wide, deep cavity in a large, dead oak in a tract of swampy, mixed woods near his home in North Middleboro, Mass. (pl. 42). How long it had been previously occupied nobody knows. This old cavity came very near being a death trap for me; I shinned the old trunk without my climbers, and, in reaching into the deep cavity for the eggs, I slipped and my arm became tightly wedged in the narrow slit at the lower end of the opening; I struggled hopelessly for 25 minutes (by the village clock), calling in vain for help, before I finally tore my arm loose and dropped exhausted to the ground.

These owls occupied this old cavity until 1905, when the tree had rotted so badly that a hole developed just below the nest and the eggs rolled out. We found these owls off and on up to 1928, nesting in these woods in old hawks' nests or in other hollow trees; they may be there still, for we have not hunted there carefully since. The above records, however, cover a period of 33 years.

The Scotland pair had been regularly robbed by another collector for a number of years before Mr. Job and I discovered it in 1897, in an extensive tract of heavy pine timber. Cutting off the pines began soon after this, and the owls were obliged to shift about from one patch of pines to another, as one lot after another was cut. In 1927 we found our last nest there, after a lapse of 31 years, and soon after that the last of the pines were cut. Except for an unsuccessful attempt to nest in a neighboring cedar swamp, this pair always nested in old hawks' nests in the white pines. Arthur C. Dyke tells me that he found these owls nesting in these pines every year from 1894 to 1898, inclusive, which gives them a record of 34 years.

The Winnecunnett pair has a record of 26 years, 1905 to 1930, inclusive, though this pair also was much disturbed by cutting in the woods and was obliged to nest in five different groves of pines, one of which was a quarter of a mile away. In all these cases a pair of red-shouldered hawks nested regularly in the same tract.

A more recent experience illustrates the remarkable attachment of these owls for a favorite locality in spite of adverse circumstances. We had found a pair nesting for two seasons, 1932 and 1933, in a cavity in a dead oak stub in some swampy, mixed woods. When we visited the locality in 1934 we were disappointed to find some woodchoppers at work there; they had cut 130 cords of wood all around the old stub and were still cutting on March 31. They said that they had seen and heard the owls repeatedly every day and that they were nesting again in the old stub, which now stood out almost alone in the big clearing. In spite of all this disturbance of their old home, the owls had a set of two eggs in the old stub. The following year, 1935, we hardly expected to find them. The old stub had rotted out too badly to hold them, but they were loyal to their old home, in spite of its barrenness, and were living in a large white-oak stub about 50 yards away; this was a very unusual nest, as the cavity was open at the top and 8 feet deep, and it held the unusual set of four eggs.

When the barred owl's nest is in a natural cavity, no nesting material is taken in, the eggs being laid on the bare, rotten chips or other accumulated rubbish, but often the cavity is well supplied with cast-off downy feathers of the owl. Almost always a number of fluffy feathers or bits of long, soft, gray down are scattered about, clinging to the trees or underbrush in the vicinity of the nest, or seen waving in the breeze on the nest itself; these are very helpful in locating the nest. The cavities chosen are preferably roomy and often quite deep; but I have seen nests in cavities that looked surprisingly small. The 8-foot cavity, mentioned above, was by far the deepest I have seen; on the other hand, I once found a nest in an open, shallow hollow, only about 2 inches deep, in the top of an old dead pine; it was only about 30 feet above ground, and I could plainly see the owl asleep on her eggs.

When an old hawk's nest is used very little is done to it, as a rule, beyond scraping out a hollow in the old lining; but sometimes the old nest is relined with *Usnea* or fresh, green sprays of white pine; occasionally the rim of the nest is built up somewhat with fresh sticks, and rarely it is profusely lined with green pine needles; usually it is deeply hollowed. Old squirrels' nests are made of softer materials, and when one of these is used the owls remove the top structure and hollow out the center, so that not much more than the shell is left; one that I measured was hollowed out to a depth of 9 inches, so that the owl sank down into it out of sight; the eggs were laid on what rubbish remained.

Barred owls are slovenly and careless with their nests; I doubt if they ever succeed in building a satisfactory nest for themselves; if they attempt it, they generally make a poor job of it. If they cannot find a good nest to appropriate, they will take a poor one and often fail to make it secure. I have recorded in my notes six cases where the nests were so insecure that the eggs rolled out and were broken. The North Middleboro owls stuck to their old rotten stub until a hole developed in the back of it and the eggs rolled out. The Scotland pair twice attempted to nest in such flimsy old nests that the eggs fell out and were broken, once through a hole in the center and once through a broken-down side; we wondered if these were not attempts at nest building by the owls.

Some interesting "partnership" nests have come under our observation. A very old nest in a large beech tree (pl. 41), in the North Middleboro woods, has yielded us four sets of red-shouldered hawk's, one set of barred owl's, and one set of great horned owl's eggs; it was probably originally built by the hawks. Once we were almost sure that we saw a barred owl fly from this nest, but we found that it held three eggs of the hawk.

The "reservoir woods", in Rehoboth, had long been the home of one of our old reliable pairs of red-shouldered hawks until 1924, when a pair of barred owls came in for the first time and occupied the hawk's nest of the previous year, 48 feet up in the main crotch of a large scarlet oak. Four years later this nest was occupied by a pair of red-tailed hawks. Since then no hawks or owls of any kind have been found in these woods.

Mr. Job (1908) tells of a nest in Seekonk, Mass., from which a barred owl had been flushed several times. He went there one day to photograph the owl but was surprised to see a red-shouldered hawk fly from the nest, which was found to contain three eggs of the hawk. Someone took these eggs, but later on the nest was found to contain two eggs of the owl and one of the hawk.

Dr. Louis B. Bishop has sent me his notes on two mixed sets of eggs of these two species, which he collected near New Haven, Conn., in the same tract of woods in two different years. He had collected seven sets of eggs of the hawk there during previous years. The first nest contained three eggs of the hawk and one of the owl, the former somewhat advanced in incubation and the owl's egg fresh. The owl was on the nest, and the nest contained many downy feathers of the owl, but none of the hawk. This nest was about 300 yards from a nest often used by the hawks, from which he had once taken a set of barred owl's eggs. The second nest was found the following year, and probably the same birds were responsible for it. It contained two eggs of the hawk and one of the owl, all somewhat advanced in incubation; the hawk was incubating. It would be interesting to know whether both species would share in the incubation and in the care of the young.

Judge John N. Clark (1887) writes of a nest near Saybrook, Conn., built by a Cooper's hawk, 80 feet from the ground in a giant chestnut tree, which was occupied during four successive years by the Cooper's hawk, a great horned owl, a red-tailed hawk, and a barred owl. Walter A. Goelitz (1916) found a barred owl nesting in a hollow stub within 5 feet of an occupied nest of a red-shouldered hawk, in Piatt County, Ill. William W. Rubey (1927) tells of a pair of barred owls that nested in a wooden packing box put up in a tree by boys: "The tree stood in a small, open grove, surrounded by houses and streets, and only 90 feet from a large residence. The box (1½ by 1½ feet, open above and 2 feet deep) was mounted 24 feet above the ground in a large tulip tree, and could be reached by rungs nailed to the trunk."

Eggs.—The northern barred owl lays ordinarily two or three eggs, oftener two than three, and rarely four. Three eggs seem to be commoner in western sets and two eggs in eastern sets. In my 38 nests were 28 sets of two, 8 sets of three, and only 2 sets of four. Of 23 sets in the J. P. Norris collection, 13 are sets of two and 10 sets of three; this includes 4 sets of three and 2 sets of two from Iowa. There is a set of five in the United States National Museum, but it may have been laid by two birds. The eggs are oval or rounded-oval in shape; the shell is more or less granulated, slightly rough to the touch, and not glossy. The color is pure white. The measurements of 82 eggs average 49 by 42 millimeters; the eggs showing the four extremes measure **55.5** by 44, 52 by **45**, and **42.5** by **37.5** millimeters.

Young.—The incubation period is said to be between 21 and 28 days; I suspect that the latter figure is more nearly correct. The female is supposed to do most of the incubating. Only one brood is raised in a season, but, if the first set of eggs is taken, a second set will be laid about three or four weeks later; sometimes even a third set may be laid.

Young barred owls are hatched with their eyes closed, but by the end of a week their eyes are partially opened, they begin to show some activity when handled, and are able to utter a faint peeping sound. The young are brooded by their parents most of the time until they are at least three weeks old, when they begin to move about more and are beginning to show fight when handled, snapping their bills, turning over onto their backs, and presenting formidable sets of claws; one has to handle them with heavy gloves.

The coming and going of the adults and the increasing activities of the young reduce what was once a well-built and deeply hollowed nest to a smaller and flatter platform; this makes the nest increasingly dangerous as a cradle for the young, and the old owls do not seem to know how to meet the situation. I can remember at least three young, half grown or less, that have fallen from the nest; one of these disappeared, probably killed and eaten by some predator. I happened to see one of the others fall, in attempting to back up to the insecure edge of the nest; the fall of 57 feet did not seem to have hurt him seriously, so I returned him to the nest. The third one I found at the base of the tree, apparently unhurt after a fall of 45 feet.

When about four or five weeks old, the young are able to climb out of the now dilapidated nest and move about among the surrounding branches before they are able to fly; I have never seen them on the ground at this age, as I have several times seen young great horned owls. A young bird that I took from a nest, when fully three weeks old, refused to eat unless food was actually placed in his mouth, from which I infer that the old birds must tear up the food and feed it to the young up to this age at least.

I have some evidence to indicate that young barred owls are attended, and probably fed, by their parents during their first summer and perhaps much longer. On August 7, 1935, my cousin, Arthur R. Sharp, Jr., shot on his farm and gave to me two young owls that were probably fully four months old, that were being followed about by at least one of their parents, and were apparently calling upon them for food. He has sent me the following notes on his experience with them:

"Shortly after I had heard a barred owl hoot, not more than 100 yards away, a squeaking noise, at first supposed to come from a rat, issued from the same direction though it seemed nearer. On approaching, it became increasingly apparent to me that this frequently repeated sound came from two birds situated where the original hooting had been heard. As the first bird fell to the gun, the second flew about 50 yards into the woods and again began to squeak. They proved to be young barred owls, practically fully grown and well feathered except for the head, which was still covered with feathery down.

"The call was a squeaky sound verging on a hiss and might be described as a sibilant squeak. Each call lasted about three seconds and was repeated regularly at intervals of from 10 to 30 seconds. It can be fairly imitated by curling both lips outward, drawing the lower lip over the upper teeth and, with jaws tight together, sucking in slowly. The sound ends at a higher pitch, which is accomplished by sucking faster.

"To see if the old owl would decoy, I imitated this sound over a 45-minute period, starting an hour after the death of the young. The only result was an unproved sound, almost a whisper, which can be described as *wu-wu-wu*, in the same cadence as the note of the katydid, not unlike but much lower and fainter than that of the barred owl. This call was made six times from five different positions, making almost a circle around our position, and taking in all about five minutes."

Frank Bolles (1890) took two young barred owls from a cavity in a giant beech and raised them in captivity. They developed into very interesting pets, and he has written a full account of his experiences with them. At first "they were savage, using beaks and claws vigorously. * * * No one's fingers were safe inside the bars when the young gluttons were hungry. When satisfied they were stolid, and did little beyond moving their heads and snapping their beaks." Later they became very tame, and he was able to carry them about with him on long tramps through the woods and fields; they sat contentedly on a stick that he carried in his hand, or perched wherever he left them on any other object, and were always ready to return home with him. They always attracted large gatherings of small birds of many species, particularly flickers, blue jays, red-eyed vireos, and chickadees, which showed their animosity in no uncertain terms.

Plumages.—When first hatched the young barred owl is fairly well covered with thick, soft, pure-white down, quite silky on the back. When between two and three weeks old, the white down begins to be pushed out and replaced by the secondary down, or first downy plumage; on the back and wings these downy feathers are broadly white terminally and basally buffy, broadly banded with "bister"; the downy feathers of the breast are similar but paler; the belly, flanks, and thighs are clothed with long, soft, fluffy down, longest on the thighs, basally light buff, and terminally yellowish white to white; at this age the wings are starting to grow, but not the tail.

During the next two or three weeks the wings grow rapidly, and the downy plumage becomes more fully developed, the white tips becoming more conspicuous above, and the under parts, including the flanks and belly, becoming irregularly barred or spotted with "wood brown" on a grayish-white ground color and with less buff showing basally.

The molt into the first winter plumage begins at this age with the appearance of the first firm feathers on the back and scapulars. The long feathers of the flanks and abdomen, each with a broad, median stripe of dark brown, appear next, and are fully grown before the transversely barred feathers of the upper breast are perfected. In two young birds taken on August 7, about four months old, the heads are still mainly covered with the soft, juvenal, downy plumage; and the long, soft, downy plumage covers the thighs.

By late in September, in New England, the young bird has a fully developed first winter plumage, showing the transverse barring on the upper breast and the longitudinal striping on the belly and flanks. It is now like the adult, except that the general tone is slightly browner, with buff instead of white bars on the hind neck and with more pale buff on the under parts; the light bars in the wings and tail are also tinged with buff. These buff tints all fade away during the winter, so that old and young birds are indistinguishable by spring. Adults apparently have a complete molt during summer and early in fall, but molting birds seem to be very scarce in collections.

Food.—The food of the barred owl is varied and includes many species of mammals, birds, reptiles, amphibians, fishes, and insects. It is, on the whole, decidedly a beneficial species, as most of its food consists of injurious rodents and other animals of doubtful value, and it does very little damage to poultry and game. Dr. A. K. Fisher (1893b) reports that "of 109 stomachs examined, 5 contained poultry or game; 13, other birds; 46, mice; 18, other mammals; 4, frogs; 1, a lizard; 2, fish; 14, insects; 2, spiders; 9, crawfish." He quotes several authorities as saying that this owl is very destructive to domestic poultry, particularly young chickens; but his investigations showed that poultry formed a very small part of its food. What few game birds are taken are probably the weaker or more sickly individuals, thus preventing reproduction from unhealthy parents and improving the strength of the race. Mice seem to form the bulk of the food; he says that Dr. C. Hart Merriam took the remains of at least a dozen red-backed mice from a single owl.

The following mammals have been recorded in the food of the barred owl: Mice of many species, rats, chipmunks, gray, red, flying, and fox squirrels, young hares, rabbits, minks, opossums, weasels, moles, shrews, and bats. The list of birds is still longer; it contains chickens, pigeons, doves, grouse, quail, small owls, purple gallinule, flickers and other woodpeckers, kingfisher, crow, blue jay, cardinal, towhee, junco and other sparrows, blackbirds, various warblers, swallows, brown thrasher, catbird, and robin and other thrushes. Other items are frogs, crayfishes, lizards, small snakes, snails, slugs, salamanders, flesh of a terrapin, perch, hornpout and other fishes, grasshoppers, crickets, large beetles, and spiders.

Dr. Paul L. Errington (1932c), in summarizing his study of the food of this owl, says:

> It can perhaps be surmised from the data, without discussion, that the food of the Barred Owls was determined in the main by what was available to them. Their food was further determined by what was within the power of their weak feet to kill. The ordinary size limit for avian prey was the flicker; for mammalian prey, moles and part-grown cottontails. The mink listed in no. 20 is the one glaring exception that I have encountered, though it is not to be said positively that the mink had not died from causes other than Barred Owl talons. Possibly it had attempted liberties with the tethered owlet. Altogether, the Barred Owl seems endowed with about as mild a personality as a raptor could have and yet maintain a predaceous existence, in some instances subsisting for considerable periods upon large invertebrates (insects and crayfish) or upon fish or amphibians.

He says elsewhere (1930) that "in one experiment 55 English sparrows (released alive in cage) were eaten in 154 hours" by one owl; and 49 sets of mandibles were recognized in the pellets. This partially upsets the theory that pellets are unreliable as indicators of birds eaten.

Mr. Bolles (1890) says that his captive owls considered mice "a rare treat, and they swallowed them without hesitation, head foremost." He once "found a large number of mice in a barrel of excelsior. Carefully taking out most of the packing," he placed one of the owls in the bottom of the barrel. "The mice spun round him in confusing circles, but with great coolness he caught one after another until nineteen were disposed of. The Owls between them ate the entire number within six hours." They had never seen fish until he put some live perch and bream in their bathing tank, but they soon caught and ate them all. They also caught and devoured live frogs that he placed in their cage. He could not keep the owls in the sunny cellar where his hens were, for they caught and ate some of his pullets "and terrified the survivors so that their lives were a burden."

Lewis O. Shelley has sent me some interesting notes on the capture of a cottontail rabbit by a barred owl in winter, and a diagram showing their tracks in the snow. He says that "the owl's talons, from visible signs, became fastened in the rabbit's back, midway; and for an even, erratic 84 yards the rabbit ran, with the owl holding fast and every so often flapping its wings to maintain a balance, or trying in vain to launch into the air, as wing marks in the snow, on either side of the trail made by the rabbit, showed. For all this distance the rabbit labored, not on a steady run, but with spasmodic hops and rushes, for its belly every so often flattened into and trailed the snow." The rabbit tried twice to free itself from its enemy by running under bushes or low branches, but in vain. Where the conflict ended was found "an owl pellet and a rabbit's hind leg. The fur-lined arena held numerous rabbit tracks and those of the owl."

There is plenty of evidence that barred owls do much of their hunting in broad daylight. I have several times seen one flying about in the open. A. D. DuBois tells me that he saw one "fly to the ground several times, in a low woodland, where it caught and ate some sort of prey." C. L. Rawson (1883) saw one that was clinging "to the top of a white birch with one claw, and was tearing away at a squirrel's new domed nest with the other claw."

Dr. George M. Sutton (1928) writes:

> The Barred Owl is apparently the enemy of all the smaller owls. On May 31, 1923, a Barred Owl was seen chasing a Screech Owl, the smaller creature crying out in mortal terror. One killed on May 12, 1922, had the remains of a Screech Owl and a Field Mouse in its stomach. The result of the big Owl's cannibalistic habits is that there are virtually no Screech Owls anywhere in Pymatuning, and where they do occur they almost never call. So far as I have been able to determine, the Great Horned Owl never preys upon the smaller owls, and I offer no evidence that the Barred Owl ever captures the Barn, Long-eared, or Short-eared Owl.

Mr. Forbush (1927) found the remains of long-eared owls in the stomachs of two barred owls, and in the stomach of one of the long-eared owls were the remains of a screech owl, a case of cannibal eat cannibal.

Barred owls, as well as some other large owls and hawks, have well-marked feeding nests, old nests to which they carry their prey to tear it up and devour it at their leisure. Such nests are often well decorated with downy feathers, and I have been tempted to climb to them on several occasions. One of these, used by a barred owl, contained the posterior half of a large hornpout, the hind leg of a cottontail rabbit, numerous bits of fur and feathers, and about a handful of small, white fish bones, such as are found in kingfishers' nests. These feeding nests are generally not far from the breeding nests, in the same patch of woods.

Behavior.—The flight of the barred owl is light, buoyant, and noiseless, with rather slow beats of its spacious wings; it often glides gracefully and skillfully among the intricacies of the forest branches, sliding upward in a curving glide as it alights. It probably is not swift enough to catch birds on the wing, but is quick enough in pouncing on its stationary prey from a silent approach. I have seen it flying high in the air when pursued by crows, but I have never seen it soaring.

Its behavior about its nest varies with different individuals; some birds fly from the nest when they hear the intruder coming; others fly when the tree is rapped; one bird, with which I was familiar for several years, always remained on the nest until I was partway up the tree; once I saw her asleep on a low nest. This bird was so tame that I had no difficulty in photographing her on her nest; while I was perched in a treetop, within 15 feet of the nest, she returned to the nest again and again to brood her young, after I had purposely scared her off; after a few attempts I had difficulty in making her leave at all (pl. 42).

I consider the barred owl a very gentle bird for a raptor. I have never had one even threaten to attack me, even when I was handling the young. The most aggressive ones have merely flown about at a safe distance, snapping their bills loudly. Other people have been attacked, however. Mr. Bolles (1890) shot the two old birds when he took the young and says: "The gun was quite necessary, for my friend would have fared badly in climbing if I had not shot the old birds before they could attack him." Dr. Sutton (1928) says: "The adults were so combative, whenever Mr. Cook climbed the tree, that he took a club with him for protection." H. D. Ruhl (1926) was attacked while handling the young in a nest, and gave his companion a chance to photograph the event; he writes:

> In order to get a picture I deliberately turned my back, took a firm grip on the trunk and began to tease the young until they would utter a shrill squeal. After a few minutes the female swooped down and struck me on the shoulders with both her feet. Although expected, the first impact was rather a surprise to me, and a new experience. The talons pierced my heavy shirt and underwear and left their marks in my skin. In about three minutes the female struck again and by this time the male seemed to think it must be a safe proposition for he, too, struck me, but with more caution and less damage. After the female had left her marks for the third time, Mr. Hurlbert thought that he must have some good films and I was more than ready to call it enough.

The prevailing impression that owls cannot see in daylight is erroneous. The eyesight of the barred owl is particularly keen. Mr. Bolles (1890) often left one of his owls perched in the open sunlight and found that it "was keenly alive to anything passing skyward, for if a Hawk or Crow came into view far away in the deep blue, Puffy's gaze was instantly turned full upon the growing speck, the eyelids partly closed and a most intense look coming into his eyes. Again and again Puffy has seen Hawks or Gulls overhead which my eyes, although unusually far-sighted, have at first been unable to discern. On one eventful day he showed me 334 Hawks sailing southwest under the pressure of a stiff northeast gale."

On the other hand, he says: "Contrary to my expectations the Owls are not appreciably more active in twilight hours than at other times, and I think they are quiet, possibly asleep, at night. I am certain that in an ordinary degree of darkness they cannot see. If the light goes out while Fluffy is flying in my cellar in the evening, he is sure to crash into something or fall heavily to the ground. I have held Puffy close to a cat in the dark, and he was wholly unaware of her presence."

Their sense of hearing is very keen, as it is with all owls. Dr. Fisher (1893b) tells of a pair that came from a distance of over 50 yards in response to a low squeaking sound he made to attract birds.

I have repeatedly had one leave a nest in a deep hollow, aroused by the slight rustling of dry leaves, as I tried to approach silently. Mr. Bolles thought that his owls depended more on sight than on hearing in securing their prey. He says that his owls not only drank but took prolonged baths whenever fresh water was given to them, even in the coldest weather.

Mr. Shelley tells me that this owl has an acumen for detecting bait at skunk traps set in burrows. In most cases the meat used as bait is anointed with an oil obtained from trout. It is a very smelly oil and seems to be enticing to owls, especially the barred owl, which has been trapped in the mouths of burrows where the bait was covered and could be detected only by a keen sense of smell. He gives an interesting account in his notes of a wounded owl of this species that he nursed back to health. The shot wounds had evidently produced a fever, for the owl was very listless, refused all food, and drank water, "taking it as a feverish person might." After two or three days of fasting, forced feeding was tried with gradually improving results. At the end of 17 days the owl had entirely recovered and was liberated.

Voice.—The barred owl is a noisy bird at all seasons, except when there are young in the nest, when it is more quiet. Its vocal performances are most spectacular and thrilling, loud, emphatic, and quite varied. The antiphonal hootings of a pair of these owls, heard at any time during the day or night, will hold the hearer spellbound; when heard close at hand at night, they are fairly startling, as if a pair of demons were fighting. Once while I was fire-lighting for deer in the Adirondacks, our canoe floated under an overhanging tree; the peaceful silence of our noiseless motion was rudely broken by a series of unearthly yells over our heads; fully expecting to see a panther, or at least a wildcat, jump into our canoe, we were greatly relieved to see a pair of barred owls fly away.

The ordinary call note, the one oftenest heard, consists of two groups of four or five syllables each, given with a rhythmic swing and strongly accented, loud, wild, and strenuous, *hóo-hoo-to-hóo-ooo*, *hoo-hoo-hoo-to-whóoo-ooo*; the first two syllables in the former group and the first three in the latter group are distinct, deliberate, and low-toned; the last two are run together, with a strong accent on the next to the last, which is the loudest of all, rising in pitch and then sliding down the scale and diminishing in volume as the final syllable ends.

There are many variations in this call, which is sometimes reduced to three, or even two, syllables, or only one group is given. Another variation is *ho-ho-ho-to-hóo-ah*, ending in a loud, harsh note. A cry that seems to express anger sounds like *ho-ho-to-wháh-ow*, or *whah-whah-whah-to-hóooo*, with loud, nasal, rasping notes, as of derisive laughter. Again I have heard two or three soft hooting notes of uniform rhythm and with little accent, in a deep base tone much like the notes of the great horned owl. Twice I have recorded in my notes a prolonged, tremulous call, *who-o-o-o-o-o-o*, much like that of the screech owl in form, but much louder. Once this note seemed to have a whining quality, which I recorded as *wee-ow-o-w-ow-ow*. I have often noticed that when a pair of owls are calling and answering each other there is a decided difference in pitch between the two voices; fancy might attritute the deep base voice to the male, but it may be just the reverse.

William Brewster (1925) has much to say about the voice of this owl. He refers to a "prolonged and cat-like scream. * * * Although coming from a distance of nearly half a mile, this outcry was so loud, so piercing and so expressive of ferocity as to be very thrilling. It ended, however, with a hoarse *hóo-ah* which could issue from no throat other than that of a Barred Owl, thus once more confirming my impression as to the authorship of the 'caterwauling'."

Referring to the nocturnal serenades heard in the spring, he says: "They consist of loud and prolonged outbursts of cackling, laughing, and whooping sounds delivered very rapidly and interspersed, as well as ending, with the familiar *ho-hòo-ah*. Although probably inspired chiefly by sexual ardour or rivalry, they seem more suggestive of loquacious and boisterous mirth. Both sexes take part in them and sometimes as many as three or four birds will be gabbling and laughing at once or in unbroken succession, making the woods ring with their almost deafening clamor, perhaps for minutes at a time."

Mr. Forbush (1927) says that the common call is often translated "who cooks for you? who cooks for you all?", which gives a very good idea of it. The call is easily imitated, and anyone who can do it well should have no difficulty in calling up any barred owls within hearing. Francis H. Allen tells me of a note that I have never heard, "a husky, whistling note, with an almost human quality, ascending sharply at the end. It might be written *shooeet*, but it has a strident quality impossible to express in syllables. It may be imitated by whistling thickly, not clearly, between the tip of the tongue and the inside gum above the upper incisors." This sounds very much like the food call of the young, described above by Mr. Sharp. Audubon (1840) refers to a "hissing noise in lieu of a call", made by the young, which "may be heard in a calm night, for fifty or probably a hundred yards, and is by no means musical. To a person lost in a swamp, it is, indeed, extremely dismal."

Mr. Shelley tells me that one night when he was out coon hunting with his hound, a barred owl four times gave a barking note, so much like the baying of his hound that he was completely fooled, until he traced the bark to the owl.

Enemies.—The misguided sportsman and the farmer with a gun are the owl's worst enemies; any hawk or owl is shot on sight, as a supposed killer of game or poultry; many large owls are shot to be mounted as ornaments, or as trophies of man's prowess. Next to man crows seem to be the owls' bitterest enemies. I have often traced the location of an owl by the clamor made by a band of noisy crows that were pestering him. No sooner does a crow discover an owl than he calls up all his friends and the fun begins. I have no evidence to show that the crows ever inflict any serious injury on the owl, but they make life miserable for him, darting at and about him and heaping upon his innocent head all the vile epithets that crow profanity and insulting language can produce. J. D. Carter (1925) gives the following interesting account of this:

> No sooner was the bird on the wing than a party of Crows, idling in the neighborhood, gave chase with all the choice expletives which are reserved for the big Owls. When perched in the midst of a cawing mob, the Owl would duck its head when one of the Crows made a dive at it, and would often counter by a thrust of the beak. When the Crows were quiet enough, the snapping of the Owl's beak could be plainly heard for 100 yards. The Owl did not make any visible attempt to use its feet as weapons. On two occasions it dived into a big hollow beech tree, leaving the watching mob outside. No doubt the Crows would have gone away in time, but in both cases the Owl came out again before they had dispersed. When perched in the open, the Owl's plan, if it had any, was to endure the pestering and profanity until the Crows one by one lost interest and drifted away; then by easy stages, approach, and finally disappear in the nest cavity. It did not approach its nest so long as a single Crow appeared to be watching. There was no loud talk near the nursery door.

Though the barred owl is a gentle bird, as a rule, he has plenty of courage and is no mean fighter when necessity requires it. In the fight between a goshawk and a barred owl, referred to under the former species, the owl was apparently the last to die, after putting up a good fight. Mr. Bolles (1890) found that practically all small birds showed great antipathy to his owls, teasing and annoying them whenever they were left in the open. But he says:

> It was when a venerable and fiery-tempered Logcock caught sight of him on August 21, that the full force of Woodpecker eloquence was let out. Puffy seemed to recognize a hereditary foe, for before the Pileated came into my view the Owl suddenly changed his appearance from rough-feathered and sleepy content to an astonishing resemblance to an old moss-grown stump. He effected the transformation by standing up very straight, nearly closing his eyes, and making his feathers lie absolutely sleek against his attenuated body. Once on another occasion when he ran away from me, he climbed to the top of a small oak stump and made himself look so like a continuation of it that I passed him four times without detecting his presence. Not so the Pileated, for with a shrieking cackle, his crest gleaming in the sunlight, he flew at the Owl so savagely that I expected to see my pet slain on the spot. He only ruffled Puffy's feathers, however, and made the poor bird unhappy for some time by his discordant cries and frequent flights and counter flights.

Field marks.—The barred owl may be recognized easily; it is a large gray owl, much grayer than the great horned owl and somewhat smaller, spotted with white above, barred *transversely* on the breast and striped *lengthwise* on the belly and flanks, with a large, rounded head, no ear tufts, large *black* eyes, and a yellow bill.

Winter.—Mr. Forbush (1927) writes:

> It winters over most of its range, but seems to desert its most northern breeding grounds in winter, where a southward migration has been reported often. In seasons of deep snow, when mice can keep under cover, and especially when northern hares are scarce, great flights of Barred Owls come from the north into New England. At such times when in search of food this species may be found almost anywhere; many come into towns and cities where they find mice, rats, sparrows, doves and starlings, on all of which they prey. In March, 1922, a Barred Owl roosted daily for a long time on the trees about the City Hall or in King's Chapel and the Granary Burying Grounds in Boston, where it attracted the attention of the passing crowds; and there was another on Beacon Hill. One remained for several days in the trees in the Public Garden, and the species was reported here and there about the suburbs.

DISTRIBUTION

Range.—North America east of the Rocky Mountains and south of Hudson Bay. Nonmigratory.

The range of the barred owl extends **north** to northern Alberta (Fort McMurray); central Manitoba (Chemawawin); Ontario (probably Rat Portage and Moose Factory); and Quebec (Quebec, St. Joachim, Godbout, and Anticosti Island). **East** to Quebec (Anticosti Island); Nova Scotia (Pictou, Kentville, and Halifax); Maine (Bucksport and Norway); southern New Hampshire (Franklin Falls and Webster); Massachusetts (Danvers, Boston, Middleboro, Dartmouth, and Muskeget Island, casually); southeastern New York (Brooklyn and Staten Island); New Jersey (Lawrenceville, Pensauken Creek, Sea Isle City, and probably Seven Mile Beach); Maryland (Laurel); District of Columbia (Washington); eastern Virginia (Bristow, Ashland, Spottsville, and Dismal Swamp); North Carolina (Raleigh and Lake Ellis); South Carolina (Georgetown, Mount Pleasant, and Frogmore); Georgia (Savannah, Blackbeard Island, and Okefinokee Swamp); and Florida (Watertown, Palatka, San 'Mateo, Fruitland Park, Merritt Island, Kissimmee Prairie, Orange Hammock, Okeechobee, Lantana, and Royal Palm Hammock). **South** to Florida (Royal Palm Hammock, Tarpon Springs, Tallahassee, Whitfield, and Pensacola); southern Alabama (Stiggins Lake); Mississippi (Bay St. Louis); Louisiana, (New Orleans, Houma, and Patterson); and Texas (Sourlake, Bellville, and Corpus Christi). **West** to Texas (Corpus Christi, Skidmore, Losoya Crossing, San Antonio, and probably San Angelo); western Oklahoma (Kenton); northeastern Colorado (Holyoke); southeastern South Dakota (Vermillion); Minnesota (Waseca, Elk River, probably Gull Lake, and probably White Earth); and Manitoba (Winnipeg, probably Portage la Prairie, and Chemawawin).

The range as above outlined is for the entire species, which has, however, been separated into three geographic races. The northern barred owl (*Strix varia varia*) occupies all northern parts of the range south to North Carolina, Arkansas, and central Texas; the Florida barred owl (*Strix varia alleni*) is found in the south Atlantic and Gulf Coast States north to central North Carolina, northern Alabama, and Arkansas and west to eastern Texas; and the Texas barred owl (*Strix varia helveola*) is confined to areas in south-central Texas.

Casual records.—The species can be considered only as a casual in Colorado although the single record for the State is based upon a pair of birds breeding near Holyoke in March 1897, one of which, with two somewhat incubated eggs, was collected. A specimen was taken at Bear Lodge, Wyo., in March 1905 and identified at the Biological Survey. It has been reported from the Yellowstone and Musselshell Rivers in Montana, but without definite details. Nevertheless, according to Saunders (1921, p. 68), two have been taken in that State for which full data are not available, while one was seen in Gallatin County, on August 5, 1909. A specimen was collected at Grand Forks, N. Dak., on November 10, 1921. Old records of the occurrence of this bird in Norway and Sweden seem extremely doubtful.

Egg dates.—Southern New England: 63 records, March 13 to May 18; 32 records, April 2 to 21, indicating the height of the season.

New Jersey: 41 records, February 28 to April 14; 21 records, March 17 to 29.

Illinois and Iowa: 23 records, February 25 to April 30; 12 records, March 6 to April 13.

Florida: 22 records, January 11 to March 10; 11 records, January 28 to February 20.

Texas: 22 records, February 17 to June 4; 11 records, February 27 to March 25.

STRIX VARIA ALLENI Ridgway

FLORIDA BARRED OWL

PLATES 48, 49

HABITS

The barred owl of the South Atlantic and Gulf States, from the Carolinas to eastern Texas, was characterized by Mr. Ridgway (1880a) as "similar to typical *nebulosa*, but toes wholly destitute of feathers or bristles, being perfectly bare to the extreme base; colors darker than in *nebulosa*, with less ochraceous, the tail scarcely barred on the basal half, and the bars on the breast much more distinct, as well as narrower and more continuous."

This southern race of the barred owl is more generally distributed and much more abundant throughout its range than is the northern race; it is especially abundant in Florida, where nearly every suitable hammock shelters a pair of these noisy owls. Here its favorite haunts are the mixed hammocks of cabbage palmettos and live oaks on the prairies, or the swampy woods in the heavily wooded river bottoms.

In Mississippi, according to Charles R. Stockard (1905), "this is the common large owl of the State, and almost every wood, large or small, has its Barred Owls. On passing along almost any country road after sunset the hoot of this owl is heard, and where the road leads through the wood it is not at all uncommon to find one or two of them perched on some lower branch of a large tree. Then the owl will incline its body forward and peer at the passer-by in a most amusing fashion, stretching and twisting its neck and bobbing its head up and down in a remarkable way."

Audubon (1840) says: "In Louisiana it seems to be more abundant than in any other state. It is almost impossible to travel eight or ten miles in any of the retired woods there, without seeing several of them even in broad day; and, at the approach of night, their cries are heard proceeding from every part of the forest around the plantations."

Nesting.—The favorite nesting sites of the Florida barred owl seem to be in the dense mixed hammocks of cabbage palmettos and live oaks, preferably the low hammocks near extensive marshes, sloughs, streams, or ponds, where they can find abundant food. One nest that I found in such a hammock on the Kissimmee Prairie was in a large cavity in the broken-off top of a dead palmetto, about 18 feet from the ground; I saw the owl fly off and climbed up to find a single young owl, about one-third grown, on a bed of rotten chips and feathers in a shallow cavity only 2 or 3 inches deep; this was on March 21, 1925. On the same day and in the same general region, I was shown another nest which had been robbed previously, in an open cavity on the top of an oak stub only 6 feet high, in a dense hammock of large live oaks.

Oscar E. Baynard showed me a nest from which he had taken a set of two eggs, in a very different location; this was in a shallow cavity below a long narrow slit, which seemed to be almost too narrow for the owl to enter, 15 or 20 feet up in a longleaf pine in rather open pine woods.

Arthur H. Howell (1932) says that in Florida the eggs are laid "not infrequently in deserted nests of the Crow or Red-shouldered Hawk."

Dr. William L. Ralph gave Major Bendire (1892) some very full notes on his extensive experience with this owl in Florida; he says: "They nearly always nest in cavities in trunks or large limbs of trees * * *. The cavities they choose for nesting sites are of all sizes and shapes. I have seen some so large that a person could easily stand in one of them, others so small that the birds could with difficulty squeeze through the openings, and again others so shallow that the tail of the sitting bird could be seen projecting from them." In only one instance did he find them using an old hawk's nest; "this nest was situated in a large pine tree, 62 feet from the ground, at a point where the trunk divided into several large limbs, and it was placed in the forks thereby formed. It was composed of sticks and Spanish moss, and lined with small twigs, Spanish moss, and feathers from the sitting birds. It was found in a wild and desolate spot about 6½ miles south of San Mateo, the tree containing the nest standing on the edge of a small but dense cypress swamp."

Three other nests are mentioned; one was "in the hollow top of a broken cypress tree standing near the edge of a small swamp"; in another case "the nesting site was a hole in the side of a cypress tree about 28 feet from the ground and about 10 inches deep"; another "nest was in a hole in the side of a very large pine tree, 21 feet from the ground. The cavity was 18 inches in diameter."

Eggs.—The eggs of the Florida barred owl are practically indistinguishable from those of the northern race. The measurements of 40 eggs in the United States National Museum average 51.4 by 43.5 millimeters; the eggs showing the four extremes measure **55** by 45.3, 53.8 by **47, 46.5** by 41.1, and 47.5 by **40.5** millimeters.

Young.—Dr. Ralph told Major Bendire (1892) that the young remain in the nest about 42 days. But many of the nests are so insecure and the parents are so careless that the young sometimes fall out and perish. C. J. Pennock saw this happen and wrote to me about it. While he was trying to photograph an owl flying from her nest, a shallow cavity in the top of a dead palmetto stub, she kicked or pushed the two young out of the nest as she left; the young fell to the ground, one was killed by the fall and the other soon died. Although they were not more than two or three days old and their eyes were not yet open, their stomachs were crammed full of flesh, bones, and hair of mice, or other small mammals.

Mr. Stockard (1905) says: "I reared a fine pair of these birds in 1903, and after they became able to fly and were set at liberty, they returned each day about sunset to their familiar feeding shelf and cried for food; they continued this habit for about one month after being liberated; I then left this locality and so was unable to observe them longer."

Food.—Southern barred owls live on practically the same classes of food as their northern relatives, with the substitution of many southern forms of life for those found in the north. Mr. Pennock says, in his notes, that "while the smaller mammals, cottontail and marsh rabbits, mice and rats of various sorts, serve them well, they are pleased to vary such a diet with almost any water-living amphibian or fish within their capabilities; fiddler crabs and crayfishes form a considerable portion of their food at times."

Mr. Howell (1932) writes: "Of 9 stomachs recently examined in the Biological Survey from various parts of Florida, 3 contained crawfishes; 3, mammals—cotton rat (*Sigmodon hispidus*), deer mouse (*Peromyscus*), and water rat (*Neofiber alleni*); 3, the remains of fishes; and 1, a large beetle."

Behavior.—The general habits of the Florida barred owl do not differ essentially from those of the northern race. Southern birds seem to be tamer and bolder, or more inquisitive, as the following two accounts will illustrate. While I was hunting with C. J. Pennock, in Charlotte County, he demonstrated his ability to call up these owls by imitating their voice. He relates the following incident in his notes: "One so called came to me as I stood by a river bank about to row down stream; after I had started afloat the bird followed and alighted on an overhanging limb, perhaps 30 feet above the water. Pulling quietly under him, he sat undisturbed while I talked to him in an ordinary tone; this performance was twice repeated, the bird following me downstream each time and taking a rather low but commanding view of the boat and passenger. He was finally left astern when the open marsh banks were reached."

Francis M. Weston writes to me: "On four occasions—involving at least three individual birds at widely separated times and places—I have had barred owls come to the 'squeak' that I use to attract small birds. All four of these occasions were between 7.00 a. m. and noon in bright weather. On two occasions the owl merely appeared, flying toward the sound and checking his flight while still 20 or 30 feet away. On another occasion, he actually passed between me and a companion, standing about 4 feet away, and hovered for a few seconds before being convinced of his mistake and flying away. The fourth time the owl came from behind me and realized his error only just in time to avoid striking me. How near his talons came to the back of my neck I have no way of knowing, but I distinctly felt the wind from his wings, when he checked his flight, and he brushed the brim of my hat as he swerved away. The whole action was perfectly noiseless, except for the momentary scraping of stiff primaries on the rough straw of the hat."

Voice.—The Florida barred owl seems to be even more loquacious than the northern bird, though this may be due to the fact that it is more numerous and perhaps more sociable. Dr. Ralph (Bendire, 1892) says: "During the first few years in which I visited these localities they were so abundant that at times—when they were mating, I think—I have heard nearly a hundred calling at once. * * * I have known them to utter their calls from the roof of the house in which I lived as unconcernedly as they do now in the most isolated swamps." He gives the call notes as similar to those of the northern bird, and says:

> Where several birds are together, sometimes in the midst of almost a perfect silence, one would begin. * * * Then another would answer in the same note, and perhaps several others in turn. After this note had been given by several birds in succession, another would utter a call like "ah-ah-ah-who-ah," or perhaps "who-ah, whack-whack-whack, who-oo-ah," which would hardly be begun before others would join in successively, some uttering the first notes and some the second, until it would seem as if every tree in the neighborhood held one of these Owls. After a few seconds' continuance at its greatest height, this racket would gradually die away until there was almost a perfect silence again, which would last for a few minutes, and then the Owls would begin to call once more. I have never heard anything that could equal one of these Owl concerts of former days, and never expect to again.

A good suggestion of the ordinary call notes is given by Arthur T. Wayne (1910) in the words *"You cook today, I cook tomorrow."*

STRIX VARIA HELVEOLA Bangs

TEXAS BARRED OWL

HABITS

This is a pale race of the barred owl, found in south-central Texas from Lee and Bexar Counties to the Gulf coast. Outram Bangs (1899) says of its characters: "The Texas bird, like *S. n. alleni*, has naked toes, but is much paler in color throughout, with all the light markings more conspicuous, and the ground color above, pale yellow or cinnamon, the wings and tail in particular being very pallid. The differences in color between the Texas bird and true *Syrnium nebulosum* are almost as great as between the great horned owls of the prairie regions and of the Atlantic States."

In the heavily wooded river bottoms and lowland forests of southeastern Texas this owl seems to be nearly, if not quite, as abundant and as noisy as its Florida relative is in similar situations in Florida. Its nesting habits are similar and it lives on much the same kind of food. It is said to be quite destructive to young poultry, where these birds are in the habit of roosting in trees. The eggs are indistinguishable from those of other barred owls. The measurements of 35 eggs average 49.4 by 42.4 millimeters; the eggs showing the four extremes measure **53.4** by 42.7, 50.1 by **45.3,** and **46.1** by **39.1** millimeters.

I can find nothing peculiar in the habits or in the vocal performances of this owl in any way different from those of the species as found elsewhere.

Dr. Louis B. Bishop (1931a) has named two new northern races of the barred owl, a darker race (*S. v. brunnescens*) from northwestern Minnesota, and a paler race (*S. v. albescens*) from Quebec; these have not yet been included in the A. O. U. Check-List.

STRIX OCCIDENTALIS OCCIDENTALIS (Xantus)

CALIFORNIA SPOTTED OWL

PLATE 50

HABITS

The spotted owl was discovered by Xantus, one of the pioneer naturalists of the Pacific coast, on March 6, 1858, and named by him on the basis of a single specimen, collected near Fort Tejon, Calif., in the southern Sierra Nevadas. This specimen remained unique until Major Bendire (1892) found the Arizona form of this species, near Tucson, in 1872. I believe it was not seen again in California until 1882, when Lyman Belding (1890) found it "common at Big Trees, Calaveras County, and vicinity in summer, and perhaps in winter." He collected a pair there on June 13, 1882, and says: "It frequents the densest parts of the fir forests."

The earlier writers knew practically nothing about this species for many years after its discovery; only in recent years have we learned anything of its life history and habits. The range of the species is now known to extend north to southern British Columbia, south to northern Lower California, and east to New Mexico and central Mexico. Throughout this range four races have been described; the 1931 Check-List recognizes only three of these, as they appear in this bulletin; Dr. H. C. Oberholser (1915) would recognize only two of these; after a study of a series of 31 specimens, from various parts of the range of the species, he concluded that the northern race should not be separated from the California race.

The spotted owl is the western representative of the common barred owl of the Eastern States, to which it is closely related and which it resembles in appearance and habits. Its haunts are in the dense coniferous forests and in the more remote and deeply shaded canyons in the mountains. Although generally distributed, it is nowhere common, and, on account of its retiring habits during the day, it is seldom seen; for these reasons it may be commoner than is generally supposed.

Nesting.—The only nest of the spotted owl that I have seen has had an interesting history. Laurence G. Peyton (1910) has written the early history of it, telling of its discovery by his father and his brother, Sidney, in May 1908, in Fish Creek Canyon, a tributary of Castaic Canyon, in the northeastern part of Los Angeles County, Calif. There were young in the nest at that time. The Peytons took a set of two eggs from this nest on April 1, 1909, and the following year, on March 30, 1910, they took from the same nest a set of three eggs and secured both of the parent birds. The Peytons did not visit this locality again until 1925, when they took a set of two eggs, probably laid by the descendants of the original pair; and again in 1926 they took another set of three eggs, making the fourth set taken from the same old nesting hole, and from at least two pairs of owls. In 1927 and 1928 this locality was visited, but the old cavity was not occupied. In 1929 the Peytons offered to show me the locality on the slight chance that the owls might be there again. This proved to be a successful venture, for we were delighted to see the head of the old owl on the nest as we approached the cliff, on April 1, 1929.

The locality was reached after a 5-mile tramp over a rough trail, which crossed a clear mountain stream many times. The canyon varied greatly in width, from narrow gorges, walled in on one or both sides with high, rocky cliffs, to open wooded valleys, or wide flat parks, or pastures. It was mostly well timbered with oak, cottonwood, willow, sycamore, and alder trees, many of large size; and along the more open, gravelly bed of the stream was a considerable growth of small willows and shrubbery of various kinds. At the picturesque nesting site the stream flowed in a double curve over a stony bed and through a narrow gorge. On the south side of the gorge an almost perpendicular cliff of rough granite rock rose for nearly 200 feet, shutting out the sunlight (pl. 50). On the north side was a steep rocky slope and near the nest was a tall cottonwood tree, the owl's favorite perch. The nest was in a roomy cavity about 15 feet up from the bottom of the granite cliff; the cavity was nearly three feet deep, and the two eggs lay on a bed of rubbish, bones of small mammals, feathers of the owl, and a lot of pellets.

Donald R. Dickey found a nest in Ventura County, Calif., containing two well-grown young on May 15, 1913, of which W. Leon Dawson (1923) writes: "The situation was an old Raven's nest, placed 65 feet up in a pothole, on a perpendicular cliff of conglomerate over 200 feet high." A set in my collection was taken by T. D. Hurd from a "depression in the floor of a small cave, or washout in a clay bank", near Riverside, Calif., on April 24, 1886. A set of two eggs in the J. P. Norris collection was taken in the same region by E. M. Haight on May 10, 1885. "The eggs were laid on the bare ground, at the base of a large rock, and the only attempt at nest building was the presence of a few feathers lying around." Harry H. Dunn (1901) took three sets of eggs from cavities in trees in southern California; one was in an oak stub some 10 feet from the ground on the side of a canyon; the second was "in an old hollow sycamore stub, which had fallen slanting across the creek bed" in Santa Ana canyon; and the third was 20 feet from the ground in a hole in a live oak. Apparently these owls seldom occupy old, open nests of other birds; but there is a set in the Thayer collection, taken by Fred Truesdale, in San Luis Obispo County, from an old hawk's nest made of oak sticks and weed stalks, 35 feet up in an oak tree, on the edge of a steep canyon.

M. C. Badger writes to me that he has found two nests of spotted owls in nests occupied by Cooper's hawks, the previous year, in Santa Paula Canyon, Calif., and that he captured a young owl at 6,000 feet elevation on Mount Piños.

Eggs.—The spotted owl lays two or three eggs, usually only two, and very rarely four; one of Mr. Dunn's sets, referred to above, contained four eggs, and is the only set of this size that I have heard of. The eggs are practically indistinguishable from those of the barred owl, though they average slightly smaller, especially in width. They are pure white and rather oval, and the shell is slightly granulated and not glossy. The measurements of 23 eggs average 49.9 by 41.3 millimeters; the eggs showing the four extremes measure **53.9** by **43.2**, **42.3** by 35.8, and 44.5 by **33.5** millimeters.

Young.—Very little seems to be known about the development and behavior of the young. Donald R. Dickey (1914), while taking a fine series of photographs at a nest containing young, noted that at about four o'clock "all the owls had a period of sudden activity. The young came to the edge and tried their wings, hopping and flapping to and fro in the exposed part of the nest hole." Some three weeks later, when he visited the locality again, he was surprised to find the two young owls and their parent perched in an oak tree some 100 yards from the nest; he says:

> That the young could have reached the spot unaided seems incredible, for although the primaries were well grown out, they were, with that exception, in the complete down, and were still weak. The alternative is that the old birds, continuing their distrust of the dangling rope, had deliberately moved them. Certain it is that they would not normally have left the nest perhaps for weeks. * * * The young were docile, downy little things of a soft grayish and buffy white. They used neither bill nor claw, and the direst threat of the larger bird was a slight parting of the bill as it shrank back from the touch of our hands.

Plumages.—I have never seen a small downy young of the spotted owl in the natal down, which is probably pure white, as it is in the barred owl. I have examined the young owl that Mr. Dickey took, which is now in his collection. This bird is nearly fully grown, and the wings and tail are nearly developed, but the body and head are in the secondary down, or first downy plumage. The head and neck are covered with soft, "cream-buff" down; the soft, fluffy feathers of the back are "clay color" to "cinnamon-buff", with three broad bars of "snuff brown" on each feather; the soft plumage of the under parts is paler, with paler bars; the long, fluffy down on the thighs is "cream-buff" and immaculate; the wings and tail are as in the adult.

Material is lacking to trace subsequent molts and plumages, but an August bird shows the beginning of the molt from the above juvenal plumage into the first winter plumage, which is apparently much like that of the adult.

Food.—Rats and mice of various species seem to be the favorite prey of the spotted owl, wood rats (*Neotoma*), white-footed mice (*Peromyscus*), and the red tree-mouse (*Phenacomys*), which forages in the forest trees. It also, probably, eats some chipmunks and other small squirrels, other small rodents, and a few birds. Mr. Dawson (1923) says: "Curiously, however, two instances are on record where remains of Pigmy Owls, *Glaucidium gnoma*, have been found in the stomachs of recently killed Spotted Owls."

Charles W. Michael (1933) found an interesting collection of pellets under a perching tree, of which he says: "Here we got a big surprise, for scattered through every pellet examined were a number of muskmelon seeds. Other identified particles contained in the pellets were egg shells, apparently hen's egg shells, hair from a ground squirrel, small mammal bones, and other bones that looked like bits of bone from a pork or mutton chop. As the owl flies, it is just about half a mile to the bear feeding platforms where owls could get such things as egg shells, melon seeds, and mutton chops."

Behavior.—The spotted owl is a decidedly nocturnal species, seldom moving about in the daytime unless disturbed. It spends the day sleeping quietly in some shady retreat, and, if forced to move, it will fly only a short distance to some other perch and promptly close its eyes and go to sleep again.

It is one of the tamest, or one of the stupidest, of the owls, as my experience with the Arizona bird and the following quotations will show. About its nest it is extremely gentle and shows only a mild interest, even when there are young to be defended. Mr. Dickey (1914) writes: "As we climbed to the young in the oak the old bird displayed her first sign of vital interest, flying within touch of the intruding heads and peering at us from close perches among the branches. But her passes at us were not fearsome things. She never even snapped her bill. Silently she swooped near, rather in an effort to see plainly, or decoy, than to harm or frighten us." Again, while he was at the nest, he says:

> As I hung there, studying at first hand the nest of the Spotted Owl, there came a last evidence of the bird's mild stupidity. Suddenly the shadow of her broad, silent wings fell across me, and I instinctively cringed. While I still clung to the nesting ledge with one hand, and to her protesting young with the other, she swept in and alit within eighteen inches of my fingers. And yet, so little of menace was in her eye and pose, that I calmly left my bare hand within striking distance until we were ready to lower away. Surely the veriest dicky-bird of them all,— * * * would do more to avenge the supposed rape of her offspring than did this taloned bird of prey, sitting idly by without apparently the courage to protect its young by fight, or the common sense to protect itself by flight.

The same observer, watching the owl at her toilet, says:

> Contorting herself into every conceivable position she shook her feathers into perfect place and carefully preened away every frayed feather tip. There was something ludicrous in her every action. Even in the midst of her toilet there were sudden periods when Morpheus seemed to overpower her and she would doze off, only to awake with a start a few moments later and continue the performance. Her movements were much more gentle than those of the horned owls. The lack of their ear tufts and yellow irides also gave her a far more agreeable expression, although I must confess that certain startled expressions,—when one did succeed in startling her,—seemed unpleasantly lynx-like. When she moved along a limb her every movement suggested a parrot, really a striking resemblance.

Grinnell and Storer (1924) write:

> In the late afternoon of July 23, 1920, on a wooded ridge-slope near Bower Cave, Mr. Donald D. McLean found himself within hearing of a clamour of bird voices. Following the clue he worked cautiously up the slope and discovered the center of the disturbance to be a spotted owl which was perched in an incense cedar, close to the trunk on a branch about 60 feet above the ground. The throng of excited birds included 19 Blue-fronted Jays, 5 or 6 California Jays, half a dozen California Woodpeckers, one Sierra Creeper, and many Cassin, Hutton, and Warbling Vireos, Black-throated Gray Warblers, and Western Flycatchers.

Voice.—The same authors say of the calls, as heard in the Yosemite:

> The notes were never given until late dusk; for example, on June 7 at 7:50 P. M.; on June 23 at 8:00; on July 24 at 7:32; on July 28 at 7:30; on October 23 at 5:25; and on November 18 at 5:10. It will be observed that these hours closely accord in the changing seasons with a certain degree of darkness. * * * These notes differed from those of any other owl of the region, in that they were abrupt rather high-pitched calls, in tone like the distant barking of a dog: *whŭ'*, *whŭ'*; *whŭ*. The first two were loudest. There was no suggestion of the deep intonation of the Pacific Horned Owl.

Frank Stephens (1892) writes: "The ordinary notes heard were a succession of three syllables, alike in tone and volume, the first followed quickly by the second and then a pause of considerable length before the third—*hoo, hoo,—hoo.* The other series of notes is different and has a curious canine quality of tone; they were usually four, uttered rather rapidly, becoming emphatic toward the end, and may be represented by the formula: *oh, oo, ou, ow.*"

Mr. Dickey (1914) mentions "a low, indrawn whistle, 'Whee e e?' with a sharp rising inflection", uttered repeatedly as she circled back from the nest to her perch, perhaps as a warning to the young, though they paid no attention to it. "Soon came the deep 'Whoo, whoo, who, who' of the other parent from far up the mountain." Again he says: "She also gave vent at this time to an utterly indescribable, turkey-like chuckle. Finally she hooted, but so low that it sounded like a dove, '*Coo'*, *coo'*, *coo*, *coo.*' * * * It probably will not hold as an invariable rule, but it is at least interesting that every time either adult hooted, they used the indicated arrangement of two long and two short notes."

Field marks.—A large, round-faced bird, without ear tufts and with large, spectral black eyes, the spotted owl cannot be mistaken for any other western owl. The brown plumage, conspicuously spotted with white both above and below, is distinctive; this color pattern produces an excellent camouflage, helping to conceal the inactive bird among the flickering lights and shadows of the forest foliage. It differs from other owls too in its tameness and apparent stupidity, which makes it an easy bird to observe at short range.

DISTRIBUTION

Range.—Southwestern British Columbia and Western United States and Mexico. Nonmigratory.

The range of the spotted owl extends **north** to southern British Columbia (Mount Lehman, Chilliwack, and the Hope Mountains); northern Arizona (Grand Canyon National Park); and northern New Mexico (Water Canyon and Santa Fe Mountains). **East** to New Mexico (Santa Fe Mountains, Manzano Mountains, San Mateo Mountains, and Sacramento Mountains); western Texas (McKittrick Canyon); Guanajuato (Guanajuato); and Michoacan (Mount Tancitaro). **South** to Michoacan (Mount Tancitaro); southern Arizona (Paradise, Huachuca Mountains, and the Santa Rita Mountains); and southern California (Mount Smith and Palomar Mountain). **West** to California (Palomar Mountain, Los Angeles, Santa Barbara, Mount Tamalpais, Bohemia, Ferndale, Eureka, and Shakleford Creek); Oregon (Siuslaw River in Lane County, probably Scio, and probably Netarts); Washington (Ohanapecosh Hot Springs, Tacoma, Kirkland, and Mount Vernon); and southwestern British Columbia (Mount Lehman).

Casual records.—One was reported as seen on August 10, 1922, ten miles west of Glacier National Park, Mont. The late C. E. H. Aiken reported that one killed near Colorado Springs, Colo., was brought to him about 1875 and that he had seen another in Deadmans Canyon in the same general vicinity during June or July 1873. The disposition of the Aiken specimen is unknown, and, since other Colorado records are not considered satisfactory, the inclusion of this species in the bird list of that State rests on slender evidence. All records for spotted owls in Baja California are too indefinite for serious consideration.

Egg dates.—California: 15 records, March 1 to May 10; 8 records, March 27 to April 1, indicating the height of the season.

Arizona and New Mexico: 4 records, April 4 to 17.

STRIX OCCIDENTALIS CAURINA (Merriam)

NORTHERN SPOTTED OWL

HABITS

Authorities differ somewhat as to the validity of this dark, humid coast race of the spotted owl. The 1931 Check-List refers to it the spotted owls that breed along the Northwest coast region, from southern British Columbia to Marin County, Calif. Dr. H. C. Oberholser (1915) thinks that it is not separable from typical *occidentalis* from southern California. He says:

> Specimens from California prove beyond reasonable doubt that *Strix occidentalis caurina* is a synonym of *Strix occidentalis occidentalis*, for all its peculiarities are to be found among these California birds. Many of the specimens of *Strix occidentalis lucida* from Arizona and New Mexico are fully as dark above as *Strix occidentalis caurina*, and some are even darker; several are as dark below, with nearly the same amount of ochraceous suffusion posteriorly, and with practically an equal amount of mottling on the legs and feet. In the reduction of light markings on the upper surface the type of *Strix occidentalis caurina* may be closely matched in all respects by some of the California birds, as well as by the type of *Strix occidentalis occidentalis*. Moreover, the type of *Strix occidentalis occidentalis* is an old, formerly mounted specimen, and is considerably faded and apparently otherwise discolored. Another southern California example is actually identical with the type of *Strix occidentalis caurina*, except for being *darker*. There is thus no distinctive character left for the recognition of *Strix occidentalis caurina* as a subspecies.

Although Dr. Oberholser examined the type of *caurina*, it was the *only* specimen he had from the Northwest coast region; moreover, it was a summer bird and probably was somewhat worn and faded. The material that I have examined, 10 birds from California and 4 from the Northwest coast, shows that the characters given for *caurina* are constant and fairly well marked. Dr. C. Hart Merriam (1898), in naming this race, gave it the following characters:

> Similar to *S. occidentale* but everywhere darker. In general the white spots and markings are smaller; the dark areas larger and darker. This is especially noticeable on the head and back where the white spotting is reduced to a minimum. The dark markings on the sides of the breast, flanks and feet are very much darker and more extensive than in *occidentale*. But perhaps the most striking difference is on the wings. The primaries are not only very much darker but the broad whitish tips have disappeared and are represented by an indistinct pale band mixed with a little whitish on the outer side of the vane and on some of the feathers a faint whitish terminal edging. The three or four pale bars nearest the tips of the feathers are also obsolescent.

On May 10, 1911, a dark, rainy day, while collecting birds near Kirkland, Wash., across the lake from Seattle, I was fortunate enough to secure a fine specimen of this rare owl. Squeaking to call up any small birds that might be within hearing, I was standing in a little open space in a dense forest of giant firs, in the midst of which stood a lone dead fir. After a few extra loud squeaks, I was surprised to see a large owl fly from the dense shade of the forest and alight on the dead tree, looking for the expected prey. The owl paid no attention to me and was easily secured. My companion, Rollo H. Beck, obtained two other specimens in the same way. I have no doubt that this owl is much commoner in the heavy coniferous forests of that region than is generally supposed; but few specimens have been taken there, and none of my Washington friends has been able to find a nest. So far as I know the nest of the northern race has never been found.

The only published note I can find on the behavior or voice of this owl is the following by C. I. Clay (1911):

> Soon after darkness fell over our camp, we were attracted by an odd, nerve-racking noise. It would start with a kind of long-drawn out whining, gradually increasing to a more grating sound, which gave rise to uncertain thoughts, as to its source. It first seemed on the hill-side across the creek, then came nearer, all the while increasing in distinctness, and finally seemed to be double, with ever increasing loudness, until the woods seemed uncanny. My curiosity was aroused to a nervous pitch, and I found it hard to induce my wife to follow me with a paper torch. * * * After following in the direction of the noise for some little distance, I located the ghostly racket nearly over my head in a large maple tree. The noise never ceased, but was continually repeated; and save the smooth branches, sparingly tipped with rustling leaves, as they swayed under the strain of the gentle night breeze, nothing could be seen except the twinkling blue background. Finally, I remarked, "It's an owl." A spread of wings was plainly visible now, and right on a bare limb, not over three feet above my head, sat an inquisitive owl with craning neck. Then came another from higher up and perched beside the first. They were attracted by the light, and sat there stretching their necks, with as much curiosity as I had shown, at the sound of a noise that seemed almost panther-like."

STRIX OCCIDENTALIS LUCIDA (Nelson)

MEXICAN SPOTTED OWL

PLATE 51

HABITS

Based on a single specimen from "the forested mountains about the southern end of the Mexican tableland (above 6,500 feet)", Dr. E. W. Nelson (1903) described the Mexican spotted owl as "darker and with much less yellowish buffy suffusion throughout than in *S. occidentale;* white markings larger and clearer white." He says further: "The shade of brown in *S. o. lucidum* approaches more nearly to that of *S. o. caurinum* than to that of typical *occidentale,* yet owing to the greater intensity of the buffy suffusion and the small size of the white spots on both upper and under parts of *S. o. caurinum* it is much more distinct from *lucidum* than is *occidentale.*"

Some time later Harry S. Swarth (1910b) discovered that the Arizona bird is distinct from the California bird and named the former *S. o. huachucae,* based also on a single specimen; he described it as "similar to *Strix occidentalis occidentalis* (Xantus), but slightly smaller, and conspicuously paler; white markings more extensive and dark areas less deep toned." He says further: "The spotted owls from southern California are about intermediate in color between the very pale Arizona race (*huachucae*) and the very dark, northwest coast form (*caurinus*), though somewhat nearer the latter." Still later Dr. H. C. Oberholser (1915) finds that the Mexican bird and the Arizona bird are identical, and, as the former description has priority, the name for this race becomes *lucida.* It is interesting to note, in the above descriptions, that, in what we now consider as one race, the Mexican bird was described as *darker* and the Arizona bird as *lighter* than the California bird. This may be explained by Dr. Oberholser's statement that "our investigation has resulted, furthermore, in the interesting discovery that there are two well-marked color phases in *Strix occidentalis,* the lighter of which is of comparatively rare occurrence." The most reliable character by which the races can be distinguished seems to be the number, size, and whiteness of the spots; one extreme exists in the northern bird (*caurina*) and one in the Mexico-Arizona bird (*lucida*), the California bird being strictly intermediate. As it seems unwise to recognize intermediates in nomenclature, the author agrees with Dr. Oberholser that there should be but two races named; as the California bird is nearer to the Northwest coast bird than to the Mexican bird, it should be included with it under the name *occidentalis,* which has priority over *caurina.* The evidence presented under the discussion of the northern race does not alter the fact that the California bird is an intermediate and that there should be but one name for the birds now called *occidentalis* and *caurina.*

Mr. Swarth (1910b) says that this owl "is possibly quite generally distributed through the higher mountain ranges of Arizona, though the published records of its occurrence are but very few and rather unsatisfactory." His specimen was taken in the Huachuca Mountains "on Sutherland's ranch, near the mouth of Cave Cañon, on the west side of the mountains at an altitude of approximately 5,500 feet. Others were observed at various points in the range up to about 9,000 feet, usually in dense clumps of maples in the creek beds, or in the thickets of quaking aspen."

J. Stokley Ligon (1926) says that, in New Mexico, "the favored haunts of the bird are deep, narrow, timbered canons where there are always cool shady places, at elevations ranging from 6,500 to 9,000 feet. They are usually to be found sitting in young spruce or fir trees or in a cave or crevice in the shaded canyon wall; cliffs and caves being one of the range requirements of the birds in the region referred to. They may be observed in the quietest and most inaccessible mountain sections. The birds are very often seen sitting twenty or thirty feet from the ground on a small horizontal limb near the trunk of a spruce or fir."

Nesting.—To Major Bendire (1892) belongs the honor of discovering the first nest of this owl, near Whipples Station, Ariz., on April 17, 1872, of which he writes:

> My attention was first drawn to the nest by one of my men, who noticed a bird sitting on it. Rapping on the trunk of the tree it flew into the branches of another close by, from which I shot it. * * * The nest appeared to me to be a new one, built by the birds themselves; it was about 30 feet from the ground and placed in a fork close to the trunk of a large and bushy cottonwood tree standing in the midst of a dense grove of younger trees of the same species. It was composed of sticks, twigs, and the dry inner bark of the cottonwood, lined with some dry grasses and a few feathers. The inner cavity was about 2 inches deep, and the nest itself about the size of that of the larger Hawks. It was readily seen from below, but not so easily observed a little distance away, the foliage of the tree hiding it pretty effectually.

O. C. Poling wrote to him: "I discovered a nest and four newly hatched young of the Spotted Owl in the foothills among the oaks at the northern end of the Huachuca Mountains in Arizona. This was on May 23, 1890. Both parents were close to the nest and took little notice of me as I approached close to them. The nest was simply a large cavity in an oak about 10 feet from the ground."

Mr. Ligon (1926) has found several nests in New Mexico; he writes:

> On April 4, 1925, I located the first nest containing eggs; this nest was in the entrance of a cave, about which pine and fir trees grew, on the south side of a steep canyon. The cave faced the north, insuring perpetual shade, and had an opening about thirty-five feet high, forming a large circular room forty feet in depth. The nest, which was an old one reconstructed, was situated on a shelf about four feet wide and thirty feet from the floor of the cave on the east side of the entrance. The overhanging roof of the cave and the perpendicular wall on the side concealed the nest from above and only by the use of an improvised ladder could it be reached from below. It was constructed of pine limbs and twigs and some small clusters of dead pine needles, and three feet or more in diameter. The cavity was about three inches deep and ten inches wide and contained no lining.

The above was probably an old eagle's or raven's nest; it contained three eggs (pl. 51). Two days later he—

> located another nest in a narrow box canon, the southern slope of which, wherever there was footing, supported a rather thick growth of young fir, fifty to seventy-five feet high. I knew this particular place to be an Owl haunt and also knew there were some old nests in the caves and crevices of the canyon wall. I investigated several old nests but none of these showed signs of having been used this season; however, up in a narrow cave or rent, which penetrated well back into the cliff that stood behind the evergreens was evidence that the Owls were inhabiting the place. An old nest in the cave was inspected and as I was about to leave it, I discovered at the entrance of the cave, about twenty-five feet up in the side wall to my left, projecting sticks and a few clinging feathers in a natural cavity or pocket. * * * The cavity, which could not have been more suitable if made to order, was just large enough to permit of the construction of the nest, about

> three feet high and three feet wide on the inside, with a little smaller entrance. This nest, which was perpetually shaded, was an old one with little indication that it had recently been repaired. * * *
>
> On April 10, in the same mountains, a third nest was found in a dense abnormal growth of Douglas fir, generally termed "witch limbs" and common among the trees in this region. * * * I had suspected that the Spotted Owl nested in the "witch limbs" of Douglas fir, as such examples of tree growth were often noted where the Owls were seen. The tree in question was 16 inches in diameter at the base with no limbs below the mass that encircled it fifteen feet or more from the ground. * * * After some difficulty I climbed to the nest but found that the bird had not laid, although she was reconstructing what was evidently a nest that had been used before.
>
> * * * On April 12, I visited this nest again and found it contained one egg.

Eggs.—Mr. Ligon (1926) says of the three eggs that he collected: "They are dull white with a very faint tinge of buff, shell faintly roughened, with no glaze apparent. The eggs are rounded ovate in shape and the measurements are 50.1 by 40.6, 49.9 by 41.5, and 48.0 by 40.6 millimeters." He also says that Bendire's egg "exhibits the same faint tinge of buff as those from the San Mateo Mountains, New Mexico. * * * The lack of gloss in all these specimens is especially noticeable when they are compared with series of the Barred Owl." Bendire's egg measures 52 by 45.5 millimeters.

Food.—The food of this owl is similar to that of other spotted owls—rats, mice, and other small rodents, with an occasional small bird. Laurence M. Huey (1932) found that the stomach of one taken in Arizona "was filled to distention with insects"; these were determined by the Biological Survey to consist "entirely of parts of at least 17 noctuid moths of the genus *Agrotis*."

Behavior.—The habits of this race of spotted owls do not differ materially from those of other races. This owl is apparently just as tame, unsuspicious, curious, or stupid as the California bird. My experience with it in Arizona was characteristic. On May 7, 1922, while walking up the trail toward the summit, through the coniferous forest at an elevation of about 7,000 feet, in the Huachuca Mountains, we were surprised to see a spotted owl sitting half asleep in a little fir sapling, which stood at the base of a giant fir. It was the first one we had seen and I was anxious to secure it, but we had no gun.

My companion, Frank C. Willard, thought he might be able to creep up behind the tree and knock it over with a club, if I could keep its attention focused on me. This I succeeded in doing by squeaking like a mouse, dancing about or waving my arms. Moving stealthily as an Indian, he made a wide circuit and gradually approached the other side of the tree without being seen; but several times the owl's keen ears detected his footsteps and looked toward him, when I would motion him to stop until I could again attract the owl's attention by renewed activity. This game continued until Mr. Willard was close behind the tree; then, reaching around the tree, he struck a sudden blow, and the owl fell to the ground with a broken skull.

Mr. Ligon (1926) says that "one generally needs nothing more than a stone or stick to kill a Spotted Owl. So fearless or reluctant were they to leave a perch to which they had become attached that by quiet maneuvering I have caught the birds by hand. They appear to fear man no more than they do any other creature and seem more annoyed than frightened when driven from their day abode."

SCOTIAPTEX NEBULOSA NEBULOSA (Forster)

GREAT GRAY OWL

Plates 53–55

HABITS

This great owl is most deceptive in size; in external dimensions it exceeds in size all other American owls; but in bodily bulk it is exceeded by the snowy and great horned owls and is but little larger than the barred owl; its long wings and tail, its large, round head, and its long, fluffy plumage make it seem much larger than it really is. I have skinned several of these owls and have always been impressed with the surprisingly small, and apparently weak, body in a great mass of feathers.

Rev. C. W. G. Eifrig (1906) gives the following figures on one that he skinned:

> The great gray owl is in appearance our largest owl, it measures in length 25–30 inches, extent (wings spread) 54–60 inches, tail 11–13 inches. Its large facial disk, much larger than in other owls, heightens the impression of largeness, besides making it appear somewhat solemn, mysterious and uncanny. The body taken out from this owl, i. e. the trunk, without skin, head and wings, measured only, length 6½ in., depth, i. e., from breastbone to back 3⅜ in., width across thorax 2½ in., weight 8–10 oz. * * * It is hard to understand how such a tiny body compared to the bulk of the bird could keep up the huge wings, heavy claws and enormous head, whose circumference measures 20 inches, the facial disk alone, 6 inches.

Mr. Eifrig's bird was somewhat emaciated, which would account for the light weight of the body, but this would not materially affect its measurements. The weights of four entire birds, of which I have records, vary from 1 pound 15 ounces to 2 pounds 14½ ounces.

The range of the great gray owl is in the timbered regions of central and western Canada, from Hudson Bay westward to Alaska and the Pacific coast, and southward in the mountains to central California. Grinnell and Storer (1924) have recently reported it as "probably permanently resident" in the Yosemite region, "found by us only in the fir woods of the Canadian Zone", at altitudes of 7,400 and 7,900 feet. They say that it "seems prone to be active during the daytime, but keeps within thick timber."

Nesting.—Baird, Brewer, and Ridgway (1905) say: "On the 23d of May, Dr. Richardson discovered a nest of this Owl, built on the top of a lofty balsam-poplar, composed of sticks, with a lining of feathers. It contained three young birds, covered with a whitish down, to secure which it was necessary to cut down the tree. While this was going on, the parent birds flew in circles around the tree, keeping out of gunshot, and apparently undisturbed by the light." Roderick MacFarlane (1891) found a nest "on the 19th July, 1862, near Lockhart River, on the route to Fort Good Hope. It was built on a pine spruce tree at a height of about twenty feet, and was composed of twigs and mosses thinly lined with feathers and down. It contained two eggs and two young, both of which had lately died."

During his trip down the Mackenzie River in 1904, Edward A. Preble (1908) discovered a nest, of which he writes:

> While passing an extensive "brulé" on the left bank during the afternoon o June 6 I noticed a large nest on a tree about a hundred yards up the side of the valley from the river. On a nearer approach a large gray head became visible over the edge of the nest, and I realized that I had discovered a nest of the great gray owl. Making a landing, I made my way through the tangled mass of fallen timber to the base of the tree and by a few raps with the ax induced the sitting bird to leave the nest. She darted with a rapid swooping flight toward the nearest woods, but as I desired her for a specimen, I shot her before she gained its shelter. The nest was about 50 feet up in a large dead and leaning spruce; and as I did not dare to climb it, I felled the tree to secure the young birds which I felt sure the nest contained. They proved to be two in number, evidently 2 or 3 weeks old, and were clothed with grayish down. In the nest were the partially eaten remains of three young rabbits about the size of red squirrels. The nest was a platform of sticks, nearly flat and practically without lining, and measured about 2 feet in diameter.

A. D. Henderson sent me a set of three eggs of the great gray owl which he took near Belvedere, Alberta, on April 30, 1922; the nest was about 40 feet up in the crotch of a balsam poplar, in poplar woods; it was an old hawk's nest built up by the owls with twigs, well cupped and lined with bark strips and a few feathers; incubation was slight.

Mr. Henderson (1915 and 1923) has published some notes on eight other nests of this owl, found by him near Belvedere. These were all in poplar woods or mixed poplar and spruce woods. One was placed in a dead poplar and the others were in live balsam poplars or aspen poplars; two were 50 feet, one 45, one 40, three 35, and one 30 feet from the ground. They were all old nests of goshawks, red-tailed hawks, or broad-winged hawks and had very little or no lining brought in by the owls.

Frank L. Farley writes to me that this owl nests in the muskeg country "less than 100 miles north of Edmonton. On May 7, 1931, A. C. Twomey found a nest in which were four eggs. This nest was placed in the crotch of a poplar tree about 50 feet from the ground.

It resembled other nests used by great horned owls, except that it was lined with the tips of green pine needles and twigs."

Since the above was written, Dr. Thomas S. Roberts (1936) has reported the taking of a nest and eggs of the great gray owl in northern Minnesota, on April 4, 1935. The locality was on the north slope of a hill and but a short distance south of the Canadian line. The nest, which is now in the University of Minnesota Natural History Museum, "contains both down and feathers unmistakably those of the Great Gray Owl and the eggs agree perfectly with descriptions of the eggs of this species. The nest was in a dense tamarack swamp and rested about 13 feet from the ground in the crotch of a medium sized tamarack tree. It was built externally of tamarack branches and twigs and lined rather thickly with deer hair with an admixture of shredded bark, rootlets, and sphagnum debris. The three eggs were perfectly fresh."

Eggs.—The great gray owl has been known to lay anywhere from two to five eggs, but three seems to be the commonest number. In the nine nests reported by Mr. Henderson, there were 5 sets of three, 3 sets of two, and 1 set of five. The eggs are small for the size of the bird, and are not so rounded as the eggs of most other owls, being between oval and elliptical-oval. The shell is rather roughly granulated and not glossy. The color is dull white. The measurements of 52 eggs average 54.2 by 43.4 millimeters; the eggs showing the four extremes measure **58.7** by **49**, **48** by 42, and 53.4 by **41** millimeters.

Plumages.—The three, presumably very small, young found in the nest by Dr. Richardson (Swainson and Richardson, 1831) are described as "covered with a whitish down." Two that I examined in the Biological Survey collection, evidently the two taken by Mr. Preble, referred to above, are about 7 inches long and perhaps two weeks old; they are scantily covered with "olive-brown" down, which is just replacing the long white down of the earlier stage, the latter attached to the tips of the new down.

A young bird in my collection, taken in Alaska on August 6, shows the wings and tail nearly grown and like those of the adult; the under parts are still in the soft, downy, juvenal plumage, each feather grayish white, with three or four dusky bands and broadly tipped with white; the juvenal feathers of the back and wing coverts are "olive-brown", broadly tipped with white; the long fluffy down on the flanks and thighs is grayish white, obscurely banded with pale dusky; similar down around the neck is banded with "olive-brown" and pale buff; the adult plumage is coming through on the back, scapulars and wing coverts; the facial disks and the shape of the head are not yet developed.

An older bird, taken in Alberta on September 8, is practically fully grown and in nearly fully adult plumage; the head and facial disks are like those of the adult but smaller; the upper parts are fully feathered, but there is still some downy plumage on the throat and under parts.

Adults apparently have a complete annual molt ending in November and December; an adult female, taken on December 11, had nearly completed the molt of the wings, and the body molt was in progress; two others were molting in these two months. H. S. Swarth (1930) reports a bird taken on July 28 that was "beginning the annual molt. New and old flight feathers appear in the wings."

Food.—The food of the great gray owl consists mainly of the smaller mammals, such as young rabbits and hares, squirrels, rats, mice, and shrews, with occasionally a few small birds. Mr. Swarth (1930) found in the stomach of one an adult red squirrel, "the animal's head bitten off, but swallowed otherwise entire. The owl was shot at 5 p. m., and as digestion had not begun upon the carcass the squirrel evidently had been killed and eaten in broad daylight, revealing diurnal activity on the part of this owl, which I had not suspected of it."

Dr. A. K. Fisher (1893b) reports that of nine stomachs examined, one contained a small bird, seven mice, and four other mammals. He also says: "Dr. W. H. Dall took no less than thirteen skulls and other remains of red-poll linnets (*Acanthis*) from the crop of a single bird."

Francis H. Allen (1904) saw a great gray owl near Dedham, Mass., on February 7, 1904. "It held in its claws a dead and partly eaten crow, which when it was finally dropped by the owl in flight, I found to lack the head and fore part of body and the viscera."

Behavior.—The great gray owl is apparently a very tame and unsuspicious bird, or a very stupid one. Mr. Allen (1904) says of his bird:

> The owl seemed perfectly fearless of me, but showed nervousness when the crows cawed nearby, and followed with its eyes the flight of the single crows that flew over its tree from time to time. I drove it about from tree to tree with snowballs. It flew low and always took a rather low perch—from ten to twenty feet from the ground, and usually on a large branch of a pine tree, near the trunk, though twice it alighted on the very top of a red cedar. I could get as near as height of its perch permitted and was frequently within twenty feet of it during the hour or two that I spent in its company.

Dr. Fisher (1893b) says:

> Dr. Dall considers it a stupid bird and states that sometimes it may be caught in the hands. Its great predilection for thick woods, in which it dwells doubtless to the very limit of trees, prevents it from being an inhabitant of the barren grounds or other open country in the North. It is crepuscular or slightly nocturnal in the southern parts of its range, but in the high North it pursues its prey in the daytime. In the latter region, where the sun never passes below the horizon in summer, it is undoubtedly necessity and not choice that prompts it to be abroad in the daylight. It is stated that the flight is heavy and somewhat labored, and has not the buoyancy noted in that of most of the Owls.

Mr. Henderson (1923) writes: "As I was looking through my glass at one of the birds about four hundred yards away it started to fly toward me. It came sailing along about two feet from the ground and finally lit on a fence post in front of me which I found afterwards to be just eleven paces distant. It stayed there, staring at me for about a minute and then flew to a small dead snag, and from there to the ground and then to a small stump about two feet high."

In another article (1915) he tells of the behavior of the owls at the different nests that he found. In several cases he had to rap vigorously on the tree to make the owl leave the nest; in one case "the bird remained on the nest until it was touched by the hand." Once, when the owls were perched in a low tree, he "walked right under both birds only a few feet beneath them and neither flew, only turned their heads and stared at" him as he passed.

Voice.—Mr. Henderson (1923) says of the notes of this owl: "A rather musical whistle was uttered frequently like oo-ih, sometimes very softly, and at others quite loudly. They also hooted several times, a deep booming Who-oo-oo-oo." Several authors have referred to the voice of this owl as a tremulous, vibrating note, somewhat resembling that of the screech owl.

Field marks.—This is our largest owl in over-all dimensions, but not in bodily bulk or weight. Its wings and tail are very long and broad, giving it great expanse in flight. It has a very large, round head, which seems out of proportion to the rest of its outline, with no ear tufts. Its general color is dark gray. It can be distinguished from the barred owl, the other round-headed large owl, by its much greater apparent size and by its relatively smaller yellow eyes.

Winter.—Edward H. Forbush (1927) writes:

> When the northern forests fail to produce cones for winter food of small arboreal birds; when deep snows cover the runways of mice, and grasses and weeds that feed ground-birds and when bush rabbits and ptarmigan are scarce in the northern wilderness; then we may expect an unusual invasion of Great Gray Owls. Such a combination of circumstances probably does not occur often, but in the winter of 1842–43, according to Dr. Samuel Abbott, seven of these birds were taken in Massachusetts, and probably many more were seen and went unrecorded. In the winter of 1890–91 such numbers of this species were killed in eastern Maine that Mr. Crosby, taxidermist of Bangor, received 27 specimens. Some birds from this flight reached eastern Massachusetts, where a few were taken. * * * The bird is reported here and there in northern New England nearly every winter, but is noted seldom in any of the three southern New England states. Although it is a forest bird, it may be found almost anywhere in winter outside the cities and very rarely even within city limits, but it prefers deep woods, and as it is here chiefly in winter and moves about mainly at night, it is rarely seen.

In his paper on the birds of Toronto, Canada, J. H. Fleming (1907) thus refers to it:

> Winter migrant of irregular occurrence. The great flight that took place in the winter of 1889–90 is recorded by Mr. Wm. Cross. "I have received twenty-

three specimens, and have had them reported from various parts of the Province. One of my acquaintances stationed at Barrie, received twenty-six this season. They began to come into this region in November, and increased in numbers up to February, after which they became very scarce again." This is the largest flight recorded, but specimens have been taken in December 1890, January 1894, January and March 1895, and January and February 1896; the visits appear to have ceased after this.

DISTRIBUTION

Range.—Northern parts of the Northern Hemisphere.

Breeding range.—In North America the breeding range of the great gray owl extends **north** to Alaska (Nulato, Nenana, Salcha Slough, and Fort Yukon); Yukon (La Pierre House); and northern Mackenzie (Lockhart River). **East** to Mackenzie (Lockhart River and Fort Resolution); and Alberta (Fort Chipewyan and Whitemud Lake). **South** to Alberta (Whitemud Lake); southern Mackenzie (Fort Providence, Willow River, mouth of Nahanni River, and Fort Wrigley); and central Alaska (Birch Lake and Hooper Bay). **West** to western Alaska (Hooper Bay, Yukon Delta, and Nulato). See also casual records below.

There are a few observations in more southern latitudes at dates that suggest nesting. Among these are: Quebec, an individual seen near Riviere Madeleine, Gaspé County, on August 16, 1924; Minnesota, one seen on July 12, 1928, at Bigfork, northern Itasca County; Montana, three, believed to be immatures were seen on July 4, 1931, near Stryker, and an old-time trapper and woodsman reported that one summer he had seen two adults with four young near Fortine.

Winter range.—This species is not regularly migratory, but at times (probably owing to shortage of food) it extensively invades more southern regions. During winter it has been recorded **north** to Alaska (Diamond and Fort Yukon); Yukon (Fortymile); central Alberta (Athabaska Landing and Mundare); and Quebec (Montreal). **East** to Quebec (Montreal); and rarely Massachusetts (Marblehead, Boston, and Taunton). **South** to rarely Massachusetts (Springfield); New York (Fulton County, Painted Post, and Watson); southern Ontario (Toronto and South March); Michigan (Hillman, Elk Rapids, and Salt Ste. Marie); Wisconsin (Racine and Iron River); Minnesota (Goodhue, Hennepin, and McLeod Counties); Montana (Billings, Buffalo-horn Creek, and Corvallis); and Oregon (Prospect and Medford). **West** to Oregon (Medford and Willamette River); Washington (Shoalwater Bay and Seattle); British Columbia (Chilliwack and Barkerville); and Alaska (Stikine Flats and Diamond).

Migration.—The winter movement (when it occurs) appears to be as much to the east as to the south. Nearly all the records for the eastern part of the continent are for the period October to March.

Flights of considerable numbers of these owls passing eastward along Lake Ontario were observed in 1889–90 and again in 1907.

Casual records.—Great gray owls have many times been taken or observed in winter south of what seems to be their normal range. Among these records are the following: One reported as seen on the Humber River, Newfoundland, on August 28, 1899. One taken at Stratford, Conn., on January 6, 1843; another taken at North Haven in March 1907, while a third was reported as seen near the latter point on February 4, 1934. In 1887 one was recorded as having been shot near Mendham, N. J., "many years ago", and another was reported to have been killed in Sussex County in December 1859. One was reported as found in the smokestack of a steamboat at Erie, Pa., about 1900. There are two incomplete records for Clark County, Ohio, and an unsatisfactory record for Huntsburg. A specimen was taken near Fowler, Ind., during the winter of 1897, and another was collected at Hoveys Lake, Posey County, "some years before 1913." One was taken at Hillsboro, Iowa, in 1860, and another was captured alive at Sigourney on April 25, 1921. A specimen was taken at Omaha, Nebr., on December 17, 1893. There are a few records for Yellowstone National Park, Wyo., and one was collected at Wells in April 1899. In southern Idaho a speciman was taken in December 1910 at St. Anthony. One was taken at McCloud, Calif., on September 26, 1913, while there are three records from Quincy, one being a specimen collected on May 12, 1894.

Closely allied races of this owl are found in northern Europe and Asia.

[AUTHOR'S NOTE: This owl may breed regularly within the limits of the United States, as the following two records, which must for the present be considered as casual, seem to indicate. On June 18, 1915, Grinnell and Storer (1924) collected in the Yosemite region a pair of great gray owls that had almost certainly bred near there and found a nest that probably belonged to this pair. More recently, Dr. Thomas S. Roberts (1936) has reported the taking of a nest and eggs of this owl in northern Minnesota, on April 4, 1935.]

Egg dates.—Alaska and Arctic Canada: 3 records, May 15, June 19, and July 19.

Alberta: 15 records, March 23 to May 15; 8 records, April 9 to May 1, indicating the height of the season.

SCOTIAPTEX NEBULOSA BARBATA (Latham)

SIBERIAN GRAY OWL

HABITS

The above name appears in our latest Check-List (1931) in place of the Lapp owl (*Scotiaptex lapponica*), which has long been supposed to occur, as a rare straggler from northeastern Siberia, on the Bering Sea coast of Alaska. The record of its occurrence here is based on a single specimen brought to Lucien M. Turner (1886) from the Yukon Delta, on April 15, 1876. But it now seems to be satisfactorily proved that Turner's bird, which is now in the United States National Museum, is not referable to the Siberian race. Therefore this race is not entitled to any standing as a North American bird and should be dropped from the Check-List.

Robert Ridgway, who originally recorded this specimen (1878) as *lapponica*, evidently changed his mind, for, in his latest work (1914), he says: "Specimens from the Yukon delta, Alaska, formerly referred to this form, prove to be rather light-colored examples of *S. n. nebulosa.*"

Dr. H. C. Oberholser (1922) writes:

> A recent study of available material fully confirms Mr. Ridgway's opinion, which indicates that *Scotiaptex nebulosa lapponica* should be expunged from our North American list. The specimens from the delta of the Yukon River, on which the North American record of this form was formerly based, are furthermore, no lighter than birds from Alberta in the collection of the Biological Survey in the United States National Museum, and are not to be distinguished subspecifically by either size or color from *Scotiaptex nebulosa nebulosa.*

The plate in Turner's work (1886) is misleading, as it shows a very light-colored bird; but, Dr. Oberholser tells me, this plate was not drawn from Turner's specimen but from a specimen of the Old World bird.

CRYPTOGLAUX FUNEREA RICHARDSONI (Bonaparte)

RICHARDSON'S OWL

Plates 55, 56

HABITS

Contributed by Charles Wendell Townsend

This little owl, breeding in the forests of the northern parts of our continent, and of rare occurrence in the United States during its winter migration, is, however, becoming better known and more frequently reported. Although it closely resembles the more familiar saw-whet owl, the northern bird student finds that he can easily distinguish the two species in life owing to distinctive field marks. As the Richardson's owl has been found breeding at Grand Manan Island, New Brunswick, off the coast of Maine, and has been seen in summer high up in the Green Mountains, it may yet be found to breed within the limits of the United States. Warren F. Eaton and Haskell B. Curry (1924) saw one of these birds and carefully identified it near the summit of General Stark Mountain, 3,585 feet in elevation, in the Green Mountains of Vermont on July 18, 1923.

Courtship.—Seton (1911) has given a delightful description of the love-song of the Richardson's owl, which is emitted by the male as he flies in circles about the spruce tree top in which the female is stationed: "Like the slow tolling of a soft but high-pitched bell, it came. *Ting, ting, ting, ting,* and on, rising and falling with the breeze, but still keeping on about two *tings* to the second, and on, dulling as with distance, but rising again and again." Seton listened for 20 minutes to this song on the shores of the Athabaska River on a night in May, and then went to sleep only to hear it again from time to time during the night.

A. W. Schorger (1926) heard the same song in May on a cloudy afternoon at Rose Lake, Minn., on the international boundary.

Nesting.—There are comparatively few authentic records of the nesting of this bird. One of the most complete is by Robie W. Tufts (1925), who discovered, on April 11, 1924, a nest on one of the smaller islands off the east coast of Grand Manan Island, New Brunswick. This small island is about 3 miles long and half a mile wide, covered largely with a growth of thick, stunted spruces, but with several acres of hayfields where runways of field mice are abundant.

> For the most part the land is very low-lying and the highest ridges would not be more than twelve feet above sea level. It was on one of these ridges, in an old and much decayed stump, where a pair of Flickers had at one time held forth, that the Owls had made their home, about ten feet from the ground and close to the top of the stump. At the first tap the hole was quickly and completely filled by the grey face of the bird peering down at me with slowly blinking eyes. A second thump caused her to vacate the nest. This she accomplished, however, with difficulty, since the fit was a tight one and she was obliged to hitch from side to side before getting clear. She then flew to a perch about 20 feet away where she sat nervously watching proceedings, but uttered no note. The nest cavity was about ten inches deep and considerably enlarged at the base, which was covered with a thick bed of soft decayed wood and feathers, well matted. Here were deposited five much soiled eggs, typical of the Owl tribe as to shape and but slightly incubated. After the eggs were collected and the writer had withdrawn a few yards, the female returned to the nest and for some moments was seen clinging to the entrance by her feet and fluttering there in a manner which suggested a gigantic moth. Finally, after considerable effort, she was able to squeeze in and was last seen peering from the hole just as though nothing had happened. The male bird was not seen. The ground about the nest tree was examined for pellets but none were discovered and during our stay on the island, which lasted several hours, only one was found and this contained the fur, bones and skulls of some small rodents.

Although in this case the flicker's hole seems to have been rather small for the owl, other holes of the flicker of the proper size are used. According to Dr. Fisher (1893b), "it is very partial to the old holes of the pileated woodpecker (*Ceophloeus*), which seem to be just the right size and shape to suit its fancy." Preble (1908) found near the Slave River, ten miles below the Peace River on June 7, a nest in a hole containing three young. "It was in the deserted hole of a flicker, about 20 feet from the ground in a large balsam poplar stub, in deep woods. The young were collected. Neither of the old birds was seen about the nest, but during the night the female was taken in a trap placed on a pole near by for that purpose."

Two recently found nests are described by A. G. Lawrence (1932). One of them, containing five young, was discovered on May 7, 1932, by Alex Mackie near Winnipeg, in a hole 18 feet from the ground in a dead poplar stump in open woodland country. The other nest, with five eggs, was discovered by V. Latta at Shelley, Manitoba, on May 15, 1932, in a spruce muskeg in a "woodpecker's hole about 18 feet from the ground in a dead tamarac stub, the eggs being placed in a thick bed of wood and bark chips, mixed with some owl feathers."

While the Richardson's owl is well known to nest in holes in trees, holes generally made by the larger woodpeckers, or in natural cavities, it has been stated that it also nests in the deserted open nests of such birds as the gray-cheeked thrush or the rusty blackbird, or in nests made by the owls themselves. This is said to be the case in the north where there are no large trees, but merely stunted trees and bushes. Nelson (1887) and Dall reported eggs brought to them from such nests by fur traders and Indians, but considerable doubt exists as to the accuracy of the testimony of these natives. Bendire (1892), who quotes these records, states that the eggs obtained by Nelson are unquestionably those of the American hawk owl.

Eggs.—[AUTHOR'S NOTE: The number of eggs laid by Richardson's owl varies from three to seven, but usually the set consists of four, five, or six. They are pure white and oval; the shell is smooth, with very little gloss. The measurements of 47 eggs average 32.3 by 26.9 millimeters; the eggs showing the four extremes measure **36.5** by 27.1, 35.3 by **28**, **28.8** by 27, and 30 by **25** millimeters.]

Young.—The duration of incubation is not known but is probably about three weeks. As the parents begin to incubate soon after the first egg is laid and egg-laying may take 8 to 12 days, it is evident that the young in the nest will vary much in size. A. G. Lawrence (1932) says of five young found in a nesting hole that they "ranged in size from a baby a few days old, clothed mainly in white down with the dark brown feathers appearing on the upper parts, to a well feathered youngster which had lost most of its downy feather tips, and was probably two weeks old."

Plumages.—[AUTHOR'S NOTE: I have not seen the downy young of Richardson's owl, but infer from the above statement that it is covered with white down, though Witherby's Handbook (1924) states that in the closely related Tengmalm's owl the "down is buffish-white on upper-parts and white on under-parts." We have no data on the exact age at which the juvenal plumage is acquired, but, if Mr. Lawrence's (1932) estimate is correct, it must be quite completed within three weeks. The juvenal plumage is sufficiently unlike that of the saw-whet owl to be easily recognized. The entire upper parts are clear, dark brown, from "cinnamon brown" to "mummy brown", without any lighter markings; the wings and tail are as in the adult; there are a few white spots on the forehead and about the ears; the facial disk is partially white, mottled with brown; the under parts are slightly paler, "cinnamon-brown" to "Mars brown", mottled with "cinnamon-buff" posterially, with some white in the center of the breast; the thighs and feet are "cinnamon-buff." In older birds all these colors are somewhat paler. This plumage is apparently worn until early in fall, when an incomplete molt, involving everything but the wings and tail, produces the first winter plumage, which is practically adult. Adults have a complete annual molt during summer and fall, which may not be completed until November.]

Food.—Small rodents and insects are the chief food of this bird, which may therefore be classed among the beneficial owls, although Fisher (1893b) quotes Ross as stating that in the vicinity of Fort Simpson "it produced sad havoc among the flocks of linnets." There are several reports of mice found in the stomachs of these birds, as for example one by L. R. Wolfe (1923) where three deer mice were found in the stomach of a bird taken in New York in December. Taverner (1919a) says of "9 stomachs examined, one contained a small bird; 7, mice; and 4, other mammals." Preble (1908) collected three nearly fledged young from a nest on Slave River and found their stomachs "contained the remains of white-footed mice (*Peromyscus arcticus*), meadow voles (*Microtus drummondi*), and red-backed voles (*Evotomys g. athabascae*), and a matted layer an inch and a half in thickness, composed of the bones and hair of these species, filled the bottom of the cavity [of the nesting hole]." Mr. Lawrence (1932) says of a nest of five young of this species: "To judge by the pellets ejected by the young, mice formed a great part of their food, but remains of small birds were also in and around the nesting stump."

R. V. Lindsay (1928) says of a captive example: "This particular specimen seems to prefer mice to birds as an article of diet. One evening two English Sparrows were placed in the Owl's cage. We expected to find only a few feathers the following night, but on peering into the cage we saw both sparrows alive and healthy." Two live meadow voles (*Microtus*) were then placed in the cage and all that remained the next day was one headless sparrow. Two mice daily seemed to satisfy the bird.

Behavior.—All accounts of the Richardson's owl dwell on its inability to see in daylight, and according to Nelson (1887) it is called the "blind owl" by the Eskimos. This inference is based on the fact that the bird is easily approached in the daytime and will often permit of its capture by hand, but this is true to a greater or less extent of certain other northern birds, in which cases it is inferred that the birds are stupid or confiding from unfamiliarity with man, but the inference is never made that they are blind. The spruce partridge, and even the ruffed grouse in wild regions, act in this way, and crossbills and pine grosbeaks are sometimes surprisingly tame and can be captured by slip nooses on short sticks. The "tameness" in the case of these birds is certainly not due to blindness. Forbush (1927) says of this owl: "Even if it sees only indifferently well by day, it is the exception among owls, as most of them see remarkably well then."

An experience that I had (1925) with a Richardson's owl at Grand Manan, not many miles from the nesting hole of this bird found by Robie W. Tufts the year before, leads me to think that, as in the case of the spruce partridge, its eyesight is sufficiently keen by daylight, but that unfamiliarity with man accounts for its apparent tameness. If the owl I observed was the same one that was robbed of its eggs by Mr. Tufts, it probably learned a lesson about man and was therefore wary of me. With the sun shining brightly, the owl appeared to watch me closely from the top of a telegraph pole about 30 yards away, turning its head from time to time, as if to look directly at me, while I moved about and inspected it through my binoculars for ten minutes. It was then startled by a horse and wagon and flew to a spruce tree, but it again flew from there and disappeared in the woods at my approach before I had come within 30 yards. I feel sure that it saw me, although, in the case of the horse and wagon, it may have been the noise that frightened it.

On another occasion at Ipswich in winter, Prof. F. A. Saunders and I flushed a Richardson's owl at mid-day in a grove of pitch pines in the dunes, while we were still 20 yards or more away. There are, however, numerous records of the taking of this bird by the hand, or in a hand net, in the daytime, and also of its being killed by means of a short stick. Owing to the fact that it is not often flushed and is so protectively colored, it doubtless often escapes unseen and may, therefore, be more common than is usually supposed.

Mrs. Helen G. Whittle (1923) reports the interesting behavior of a Richardson's owl that visited her feeding shelf at a window on a snowy winter day in Cohasset, Mass. On the snow below the shelf were 20 or more juncos and various sparrows at which the owl peered, "swooped down upon them (not greatly to their alarm, it seemed to us), failed to capture any, and returned to the shelf. * * * He seemed in some degree aware of our light [in the room] and of our excited interest, but apparently could not really see my husband's face inside the glass, within five inches of his own!" After this he flew into some pine trees. In a recent letter to me Mr. Whittle writes: "To this may be added, emphatically, the surprising lack of fear among the juncos and sparrows below the shelf, and not over 5 feet away, when the owl alighted on the shelf from which it inspected the birds below. The consternation to be expected among the birds under the circumstances was entirely lacking, for they paid no attention to the visitor except when it dropped among them."

A habit of this bird, which may enable it to stay in the north in winter, is related by A. W. Anthony (1906): "On March 3 [1905] a Richardson's Owl was caught on the Agapuk River [Alaska]. It had taken up its quarters in an abandoned igloo, and when driven into the glare of the outer world was confused, and after a short flight returned to the igloo and submitted without protest to capture. From an inspection of several deserted igloos in the interior of the peninsula, I concluded this species was a regular winter resident and made general use of these shelters." Of a similar nature is this report by William Brewster (1925): "Several farmers living near the southern end of Lake Umbagog have assured me that an unfamiliar little Owl resembling the Saw-whet but 'a size or two larger,' sometimes enters their barns in midwinter and occasionally remains in them for weeks at a time when the cold is severe and the ground deeply buried in snow."

R. V. Lindsay (1928) says of the habits of a captive specimen that it is "much more active early in the evening than later. On rainy days he appears quite active, and on fine days very quiet. * * * When disturbed or frightened he has a peculiar habit of swaying sideways on his perch, shifting his weight quickly from one foot to the other. He also has a peculiar habit in the evening of climbing parrot fashion around the wire front of his cage."

Voice.—The courtship song, which is sometimes likened to the tolling of a soft but high-pitched bell and sometimes to the dropping of water, has already been described. It is probable that the following by Dr. C. Hart Merriam (1882), quoting from the notes of Napoleon A. Comeau, is another description of the same song: "A slow liquid note that resembles the sound produced by water slowly dropping from a height; hence the Montagne Indians call it *pillip-pile-tshish* which means 'water dropping bird'." According to Dall, quoted by Baird, Brewer, and Ridgway (1905), "it was often heard crying in the evening almost like a human being." Richardson (Swainson and Richardson, 1831) says "its cry at night is a single melancholy note, repeated at intervals of a minute or two." Nelson (1887) says: "In one instance, while at the Yukon mouth, I heard them uttering a peculiar grating cry on a cloudy morning in the middle of May." Rev. P. B. Peabody (1899), who captured one of these owls in April in Minnesota, says: "While not actually tame, from the first he showed ecstatic delight in my stroking of the feathers on the back of his head,—chirping delightedly during the process, with much the manner and voice of a chicken when tucked under the maternal wing."

Enemies.—This little owl is doubtless the victim of larger owls and of hawks at times. Macoun (1909) records a set of four eggs, and nearby "part of the remains of the parent bird, killed by ravens that occupied an adjoining tree."

Field marks.—A little larger than the more familiarly known saw-whet owl, which it resembles in a general way, it can be distinguished from it at once by its yellow, instead of black, bill and by the dark or black outer edge to the facial disk. There are white spots, instead of streaks, on the top of its head and large round white spots on its back.

Winter.—Although these owls winter in the north to a certain extent, sometimes making use of deserted igloos for shelter, as has been mentioned already, the lack of food, owing to deep snows covering the runways of mice, generally drives them south. In the winter of 1922–23 there was a great influx of these birds into Maine, and, owing to deep snows, starvation was frequently their lot.

Forbush (1927) quotes T. A. James, curator of the State Museum at Augusta, as follows: "I am receiving a great many Richardson's owls, which appear to be starved. Most of them are picked up dead about farm buildings, and are in a very emaciated condition." Twenty-six were reported by a taxidermist of East Jaffrey, N. H., and 30 from one in Bangor, Maine. "The starving birds", continues Forbush, "left the woods in search of food and entered not only farm buildings but buildings in villages and cities, and many were captured in such situations. The bewildered, weakened birds wandered on until some of them reached the shores of Cape Cod and the valleys of Connecticut."

DISTRIBUTION

Range.—Northern North America. Not regularly migratory.

Breeding range.—The breeding range of Richardson's owl extends **north** to Alaska (Russian Mission and Nulato); Yukon (Rink Rapids); Mackenzie (Fort Simpson and probably Lake Hardisty); northern Saskatchewan (probably Fort Fond du Lac); and rarely eastern Quebec (Magdalen Islands). **East** to rarely Quebec (Magdalen Islands); and rarely New Brunswick (Grand Manan). **South** to rarely New Brunswick (Grand Manan); probably rarely Vermont (near summit of General Stark Mountain); southern Manitoba (Winnipeg and Shelley); central Alberta (Athabaska Landing); and northern British Columbia (Laurier Pass, Thudade Lake, and Flood Glacier). **West** to British Columbia (Flood Glacier); and Alaska (probably Mount McKinley, probably Tocotna Forks, and Russian Mission).

Winter range.—Probably many individuals of this species normally remain north in winter nearly or quite to the northern limits of the breeding range. Nevertheless, at this season in some regions south of the breeding range, records are too numerous for mere casual occurrence. From these it appears that in winter the range may extend **south** to southern British Columbia (Sumas, Hope, Chilliwack, and

Okanagan); probably northern Montana (Glacier National Park); North Dakota (Towner County and Fargo); Minnesota (Aitkin and Isanti Counties and Lanesboro); probably rarely northern Wisconsin (Kelleybrook); Michigan (Sault Ste. Marie and Ann Arbor); southern Ontario (Ottawa); and Massachusetts (Framingham, Hyde Park, Cohasset, Newton, Cambridge, and Seekonk).

This owl has been taken in winter north to Alaska (Goodnews Bay, January 26, 1933).

Migration.—A few large autumnal flights of this species have been observed. One occurred through the interior of British Columbia during the winter of 1898–99. During the winter of 1904 Richardson's owls were fairly common in the Red River Valley of North Dakota. For the first time in many years a heavy flight was recorded at Sault Ste. Marie, Mich., during the winter of 1922–23, the last of the season being observed on March 4, 1923. In this same season a large flight was witnessed at Ottawa, Ontario.

Casual records.—Richardson's owl has been recorded on many occasions outside of both the summer and winter ranges above outlined. Among these occurrences are the following: A specimen was collected at Bellingham, Wash., on January 17, 1905. Two were reported from Fort Sherman, Idaho, early in the spring of 1894, while there also is a report of an incomplete record from Coeur d'Alene. A male was taken at Crested Butte, Colo., on October 14, 1896, and another was collected at Breckenridge on December 28, 1882. Bones identified as this species have been reported from Shelter Cave, Dona Ana County, N. Mex. Two specimens have been taken at Lincoln, Nebr., one on December 10, 1892, and the other on October 19, 1907. In Illinois one was found at Rockford, October 15, 1884; one at Sycamore in January 1887; one at Cicero in December 1902; one at Kenilworth on December 26, 1902; and one was found dead in Chicago on March 5, 1914. A specimen was taken on November 14, 1914, at Fort Covington, Franklin County, N. Y.; and another was obtained at Plattsburg on December 16, 1922. One in the Carnegie Museum at Pittsburgh was taken in Allegheny County, Pa., on March 12, 1896. There are two records from Providence, R. I., one about the middle of December 1880, and the other in January 1881. A specimen was taken at East Windsor Hill, Conn., in midwinter about 1860, and one was found dead at Kent, on November 12, 1906.

The closely related Tengmalm's owl, *C. f. magna,* of eastern Siberia, has been recorded once from North America, a female caught alive on St. Paul Island, Pribilof Island group, Alaska, January 26, 1911. This specimen is preserved in the collections of the United States National Museum.

Egg dates.—Southern Canada: 8 records, April 11 to June 9.

CRYPTOGLAUX FUNEREA MAGNA (Buturlin)

TENGMALM'S OWL

HABITS

This is not the well-known Tengmalm's owl of Europe, but another of those light-colored races of Siberian birds that has occurred as a straggler in North American territory. Dr. Barton W. Evermann (1913) reported, under the name of *Cryptoglaux funerea funerea*, the capture of a Tengmalm's owl on St. Paul Island, in the Pribilof group, on January 26, 1911. It was caught alive in the village by a native and brought to Dr. Walter L. Hahn. "The stomach was empty save for a few hairs. This is the first record for America of this interesting little Owl."

The specimen is now in the United States National Museum and has been referred to the race of Tengmalm's owl which inhabits the Kamchatka and Kolyma districts in northeastern Siberia. According to Hartert's (1920) description, this is a well-marked race, somewhat larger than the European race and lighter-colored, and slightly larger and much lighter-colored than our Richardson's owl. The white markings on the upper parts predominate more than in other races, and the dark markings on the breast and flanks are narrower.

I can find nothing relating to the habits of this race, which probably do not differ essentially from those of the European or the American races.

CRYPTOGLAUX ACADICA ACADICA (Gmelin)

SAW-WHET OWL

PLATES 57–60

HABITS

I shall never forget the thrill I experienced when I first met this lovely little owl. It was in my boyhood days, and I was returning home just as darkness was coming on. As I was leaving the woods, a small, shadowy form flitted out ahead of me and alighted on a small tree within easy gunshot; it flew like a woodcock, but I knew that woodcocks do not perch in trees. I was puzzled, so I put in a light charge and shot it. I was surprised and delighted when I picked it up and admired its exquisite, soft plumage and its big, yellow eyes. I had never seen so small an owl, or one so beautiful. After some research in the public library, I learned its identity, and eventually had it mounted by a boy friend who knew how to "stuff" birds. Many years passed before I ever saw another.

This little owl is widely distributed throughout much of North America, but it is so nocturnal and retiring in its habits that it is seldom seen and is probably much commoner than it is generally supposed to be. Unlike the screech owl and the barred owl, it is seldom heard at night, except for a few weeks during the mating period.

Courtship.—We common mortals, who cannot see in the dark, know very little about the courtship performances of the owls, except what we can learn from listening to their springtime voices. All owls are more active and noisy at the approach of the breeding season than at other times, and the saw-whet owl is particularly so. Major Bendire (1892) quotes Dr. William L. Ralph as saying: "Just before and during the mating season these little Owls are quite lively; their peculiar whistle can be heard in almost any suitable wood, and one may by imitating it often decoy them within reach of the hand. Upon one occasion, when my assistant was imitating one, it alighted on the fur cap of a friend that stood near him." W. Leon Dawson (1923) writes:

> During the brief courting season, when alone the notes are heard, the male is a most devoted serenader; and his song consists of breathless repetitions of a single syllable, *whŏŏp* or *kwŏŏk*, vibrant and penetrating, but neither untender nor unpleasing. In the ardor of midnight under a full moon, this suitor whoops it up at the rate of about three whoops in two seconds, and this pace he maintains with the unfailing regularity of a clock. But to prevent his lady love from going to sleep, he changes the key occasionally. In quality this *Nyctaline* note is not unlike the more delicate utterance of the Pygmy Owl. * * * There can be no confusion, however, as between the incessant cadences of the Saw-whet and the xylophone "song" of *Glaucidium.*

Nesting.—Many years ago Herbert K. Job showed me a nest in an old flicker hole in a dead pine stub in which a saw-whet owl had laid three sets of eggs in a single season. As the owl had popped her head out each time he rapped the stub, I made a point of rapping every likely looking stub I passed thereafter. But it was not until March 19, 1911, that I succeeded in finding another nest of this owl in a very similar situation. I was crossing an extensive clearing, near Taunton, Mass., where a large tract of heavy white-pine timber had been cut off, when I saw a large stub of a dead white pine that the wood choppers had left as worthless; and there was an old flicker's hole in it about 18 feet from the ground. I rapped the stub, as usual, and was delighted to see a small, round head appear at the opening; thinking that we were too early for eggs and not wishing to disturb her too much, we came away and left her. I visited the nest again on April 1 and 8, to show the owl to a number of my ornithological friends, and on each occasion the owl appeared at the opening after rapping the tree or starting to climb it; she would not leave then until I almost touched her; she then perched on a small tree within ten feet of a party of 29 people, while I was at the nest. On April 11, when I came to collect the eggs, she sat even more closely; rapping was of no avail until my companion, Chester S. Day, climbed up and looked into the hole; she finally popped her head out within a few inches of his face (pl. 57) but would not leave then until he pulled her out; she then perched for some time on a small sapling nearby, where she disgorged a pellet with considerable effort. The nesting cavity was about 12 inches deep and barely large enough to admit my hand and arm. There were six eggs in the nest, one in the center and the other five around it, partially buried in the fine chips usually found in flickers' nests, mixed with numerous feathers of the owl. Incubation in the eggs varied from one-quarter to two-thirds.

Dr. Ralph wrote to Major Bendire (1892) as follows:

> We found these birds quite common in Oneida County, New York, especially in the northern and eastern parts. Their nests are not very hard to find, and it seems strange that so few have been taken. Those found by Mr. Bagg and myself were all in the deserted holes of Woodpeckers and the eggs were laid on the fine chips found in such burrows without much of an attempt at making a nest. They were all in woods, wholly or in part swampy, such situations being particularly congenial to these birds, who usually frequent them throughout the year.
>
> The first nest was taken near Holland Patent, New York, on April 7, 1886. It was situated 22 feet above the ground in a dead maple stump, and contained seven eggs ranging from fresh to slightly incubated. The second was found near the same place on April 21, 1886, also in a dead stub 40 feet above ground. It contained five young birds and an egg on the point of hatching. The third was found on the same day near Trenton Falls, New York, likewise in a dead stub 20 feet above the ground. It contained seven eggs which were heavily incubated. The fourth was found at Gang Mills, Herkimer County, New York, April 30, 1886, in a dead stump 50 feet above ground, and likewise contained seven eggs on the point of hatching. The fifth and last was taken near Holland Patent, New York, April 30, 1889, and was situated in the dead top of a maple tree 63 feet above the ground, and contained four eggs ranging from fresh to slightly incubated. I believe they lay their eggs at intervals of about two days.

Outram Bangs (1894) writes:

> On July 3, 1893, Mr. Gerrit S. Miller, Jr., and I were setting out a line of traps in a heavy white pine swamp that lies along Red Brook in the town of Wareham, Mass. We noticed a large old pine stump which was broken off about 25 feet above the ground and full of Woodpeckers' holes, and pounded on it. We had pounded but once or twice when a Saw-whet Owl popped her head out of the uppermost hole and kept it there motionless, although I fired at her three times with my pistol. The third shot killed her and she fell back into the hole.
>
> On taking the bird out, I found there was a nest containing seven eggs. The nest was quite bulky and composed of gray moss (*Usnea*) interwoven with small pieces of fibrous bark, a few pine needles, small twigs, and feathers of the bird herself. The hole in which the nest was found was 18 feet from the ground and about 8 inches deep.
>
> In the nest besides the eggs was a half eaten red-backed mouse (*Evotomys gapperi*).
>
> Three of the eggs were in various stages of incubation, one being on the point of hatching,—in fact the young bird had already cracked the shell. Three were addled, and one was perfectly fresh.

George W. Morse writes to me, on the nesting of this owl in Oklahoma: "They are apt to nest 14 to 18 feet up in an elm snag. The nest usually consists of chips of decayed wood, occasionally a few leaves surrounded by a circle of twigs from 6 to 12 inches long. These twigs protruding from the hole are frequently indications of the nest, since the saw-whet is not easily flushed by pounding on the tree, as are other species. When the female leaves, she first drops down and then flies directly up to a limb at the same height opposite the nest, alighting first across the limb, then turning parallel with it, keeping up a bobbing, peering motion of the head and neck in an apparent effort to adjust her eyes to the light and discover the cause of the disturbance."

Numerous other accounts of the nesting habits of the saw-whet owl have appeared in various publications, but they are all more or less similar. Old deserted nests of woodpeckers seem to be the sites oftenest chosen, with a decided preference for flicker holes, as these are about the right size. I believe that the owls never bring in any nesting material, but lay their eggs on the fine chips usually found in such cavities; the numerous cases reported, where other material has been found in the nesting holes, merely indicate, in my opinion, that flying squirrels, white-footed mice, or other small rodents had built their nests in these holes, and that the owls had not taken the trouble to remove the material. Most observers agree in stating that this owl will usually show itself at the entrance of the hole when the tree is rapped, its little round head completely filling the entrance, and remain there until further disturbed; this is in marked contrast to the behavior of the screech owls under similar circumstances.

There are at least two cases reported of this owl nesting in open nests of crows or herons, but I believe that these are cases of mistaken identity. The normal habit of the saw-whet owl is to nest in deep woods, or swamps, but Ned Hollister (1908) reports a case in Indiana, where "the nesting site was in a lawn shade tree close to the house." William Brewster's (1881) first set of eggs of this owl was taken from an artificial nest made from a section of a hollow trunk, boarded up at the open ends, with an entrance hole cut in the side, and nailed up in the woods. "No nest was made, the eggs being simply laid on a few leaves which squirrels had taken in during the winter."

Lewis McI. Terrill (1931) says of a nest he found in the Montreal district:

> The nesting locality of the Saw-whet Owl was by the bank of a stream draining an upland pine wood and the nest was barely twenty feet from the ground in an old cavity in the decayed top of a basswood stub, in the deep shade of surrounding saplings. It is probable that a Flicker was responsible for the excavation, but the entrance had become enlarged and ragged through decay and bore little semblance to the neatly chiselled nesting place of that bird [pl. 60].
>
> The Owl very considerately appeared at the entrance as I approached and when I reached the cavity it merely flew to a sapling six feet distant and stared at me without other demonstration while I examined the single fresh egg, resting on chips of rotten wood, ten inches below the opening. Almost as soon as I had

descended, the Saw-whet shook its feathers, flew back and disappeared into the cavity, reappearing in a moment to watch my movements. This was the usual procedure during succeeding visits, except that it was sometimes necessary to rap the stub lightly in order to bring the bird to its doorstep. The only note of protest heard in the daytime was an occasional snapping of the mandibles. This was more noticeable after the young were hatched.

Rockwell and Blickensderfer (1921) describe a nest that was in an unusual location in Colorado, quite in contrast with the usual location in deep, shady, damp forests, or near water; they say: "The tree (a large, dead yellow pine) in which this nest was located was on an exposed slope commanding a wide view of the adjacent country. The surrounding timber was sparse; the nesting cavity faced directly south into the bright sunlight and was unshaded except for a single overhanging dead branch; and the immediate surroundings were very dry. The nearest stream was fully half a mile distant and there was not even a trickle of spring water closer at hand."

Eggs.—The saw-whet owl lays four to seven eggs, five or six being the commonest numbers. The eggs are usually oval in shape, but sometimes slightly ovate or more nearly globular. The shell is smooth, with little or no gloss, and the color is pure white. The measurements of 52 eggs average 29.9 by 25 millimeters; the eggs showing the four extremes measure **31.5** by 25.2, 30 by **27**, **28.3** by 25.4, and 28.9 by **23.6** millimeters.

Young.—The period of incubation has been estimated as from 21 to 28 days; Mr. Terrill (1931) says "at least 26 days and probably longer." Both sexes are said to assist in this, but probably most of it is done by the female. The eggs are laid at intervals of from one to three days, and, as incubation begins with the laying of the first egg, the young hatch at variable intervals, and it sometimes happens that newly hatched and nearly grown young are found in the same nest.

Mr. Terrill says in his notes: "At birth the nestlings were blind and helpless and very tiny, with a scanty covering of whitish down. At the age of 8 to 9 days the eyes were partly opened and the iris was a dark inky color without lustre. When 16 to 17 days old, the upper parts were a dark chocolate-brown. The development of the eyes was very gradual, the yellow iris being first noted at this age, though the yellow coloring was not so bright and clear as at the age of 19 to 21 days, and the lids were never fully opened. At the age of 26 to 28 days one of the owlets could fly about 15 feet from a log, but was apparently unable to rise from the ground. The young left the nest some time between July 17 and 22, when the oldest was from 27 to 34 days of age and could probably fly fairly well."

Of the voice of the young, he says: "At the age of 4 to 6 days a liquid peeping was practically identical with the peeping of baby long-eared owls. Snapping of the mandibles was not noted until after the sense of fear had been developed, at the age of 16 to 17 days.

A rasping, sibilant call, heard from the nest after dark, was presumably the hunger call of the nestlings, and might be expressed thus—*t-z-z-z-z-z-z-z.* This call soon brought one of the parents which voiced its anger, or distress, in a very similar manner, though more insistently as it flew back and forth near the nest, even brushing me with its wings occasionally. This hissing might best be likened to the sound made by jets of steam escaping from a small nozzle."

Plumages.—When first hatched the young saw-whet owl is clothed in white down, which is worn for probably the first ten days or two weeks. This down then begins to be pushed out and replaced gradually by the juvenal, soft, downy plumage, which is not complete until the young bird is about four weeks old or older; between the ages of three and four weeks the tips of the first down are wearing off and the wings are growing rapidly, so that the young bird will soon be able to fly.

In the full juvenal plumage the young saw-whet is a beautiful creature, a really lovely little owl. The upper parts are deep rich browns, "auburn" on the head and hind neck, shading off to a paler shade of the same color on the upper breast and to "Mars brown" on the back and wings; the plumage of the head is particularly full and fluffy, making it seem over large; the facial disks are "Mars brown", and there is a large, conspicuous, white, V-shaped patch extending from the base of the bill up over the eyes; the middle and lower breast is "ochraceous-buff", shading off to "warm buff" posteriorly; the wings and tail are as in the adult.

This plumage is worn well into, or entirely through, the summer, depending on when the bird was hatched, when a complete molt of the contour plumage takes place, producing the first winter plumage, which is practically adult. I have seen this molt well advanced on July 25 and only just beginning on September 3; the molt begins in the face and on the under parts. Adults apparently have one complete annual molt from August to November.

Food.—The food of the saw-whet owl consists mainly of mice, especially woodland mice, small rats, young red and flying squirrels, chipmunks, shrews, bats, and other small mammals. A few small birds, such as sparrows, juncos, and warblers, have been recorded in its food; and a few insects are occasionally eaten. Dr. A. K. Fisher (1893b) reports that "of 22 stomachs examined, 17 contained mice; 1, a bird; 1, an insect; and 3 were empty." He also says: "In winter Mr. Comeau once saw one of these little owls fly from the carcass of a great northern hare that had been caught in a snare. The owl had eaten away the abdomen and was at work within the thoracic cavity when frightened away."

Illustrating the patience of this owl, as a mouser, Lewis O. Shelley has sent me the following note: "One winter, near zero weather with snow on the ground, a saw-whet owl was noticed as it perched on a sapling maple close to a back stoop at a dwelling flanked on the back and sides by woodland. The woman of the house occasionally placed pies outside to cool quickly, and mice as surely found the pastry. Perhaps the owl had seen a mouse at such a time, and when on a succeeding day a pie was put out, and the lady of the house was where she could watch it, she saw the owl perched again in the maple tree. Then a mouse crept forth and the owl's patience was rewarded, when it glided down and made its catch, making off into the woods with the mouse in its claws."

Major Bendire (1877) once had one in captivity, of which he says: "This I fed at first on live mice, the only thing it would touch, but after a while it ate the carcasses of birds, and would eat twice its own weight in a day. If several whole birds were thrown into its cage it would eat the heads of all of them first, and hide the bodies in the corners of the cage, covering them up with loose feathers. Once I put a red winged blackbird, perfectly unharmed, in the cage with it, which it at once killed. Flying to its perch it grasped it with two of its toes in front and two in rear, and always sat in this manner. I kept it supplied with fresh water, but I think it never used any."

Although this owl is mainly useful and beneficial in its feeding habits, it is a powerful and savage little fellow at times and capable of killing birds and animals larger than itself; that it can be very destructive is well illustrated by the following story, related by J. A. Farley (1924):

> Mr. E. Cutting of Lyme, New Hampshire, once told me that in the fall a few years ago he found that something was killing his Pigeons. He thought it might be a mink or a weasel or some other animal. He had 25 Pigeons that roosted nightly on sticks put up for perches in his barn. The dove-hole was close by in the barn door. Seven Pigeons lay dead one morning on the hay beneath their perches. The birds' heads were gone, some feathers were lying about and there was some blood on their bodies; otherwise there was no sign. The following evening Mr. Cutting went by stealth into his barn. By the light of his lantern he found two more headless Pigeons on the hay. Looking up he saw the "killer" perched on a beam. He despatched it with a long stick. It was a Saw-whet Owl.

Rockwell and Blickensderfer (1921) quote George L. Nicholas as follows: "While hunting in a pine wood near this town [Summit, New Jersey], I obtained an Acadian [saw-whet] owl. Upon dissecting it I found that its stomach contained a flying squirrel, which had been *swallowed whole* and but slightly digested."

Behavior.—The one characteristic most prominent in the behavior of the saw-whet owl is its tameness, stupidity, or fearlessness; it can be approached most easily, even within a few feet, and has often even been caught in the hand, or under a hat, when carefully approached. Sometimes it shows marked curiosity, or sociability. Taylor and Shaw (1927), writing of their experience with it in Mount Rainier National Park, say:

> This, perhaps the most interesting owl in the park, is one with which the camper is most likely to become acquainted, for the saw-whet seems to be a victim of uncontrollable curiosity. One evening, just at dusk, as several members of the party were seated about the camp fire at Owyhigh Lakes, one of these little owls flew into camp and perched, quite unconcerned, on a tree near the fire, as if wishing to join the circle.
>
> Another owl did the same thing at Sunset Park; and at St. Andrews the evening twilight was made particularly interesting by the movements and curious call notes of saw-whet owls. Their interest in our camp was very obvious. * * * On more than one occasion their curiosity, or stupidity, maybe, drove them into our tent. A peculiar sensation it was, to waken suddenly and hear the call of an owl sounding within 6 feet of one's ear, followed soon by the soft flutter of wings as the bird left the tent.
>
> They appeared to be most active at dusk and again an hour or so before daybreak.
>
> Cantwell describes their flight as quite unlike that of other owls, partaking more of the nature of the labored undulating flight of the small woodpeckers. Shaw says their flight is rapid for an owl, giving the bird a sprightly appearance not observed in others. This peculiar flight helps identify individuals encountered in the daytime.

My own impressions of its flight agree with those of Dr. Fisher, who says (1893b): "The flight resembles that of the woodcock very closely, so much so in fact, that the writer once killed a specimen as it was flying over the alders, and not until the dog pointed the dead bird was he aware of his mistake."

The saw-whet owl is essentially a woodland bird, oftener found in the dark recesses of coniferous woods than in the more open growth of the deciduous forest, with perhaps a preference for swampy woodlands rather than the well-drained uplands. It is seldom seen in the high treetops but prefers to hunt, or to doze during the day, at the lower levels, often within a few feet of the ground. On May 28, 1925, while looking for sharp-shinned hawk nests, in a large, dense grove of white pines in Lakeville, Mass., I noticed the broken-off top of a small pine that had lodged, about 10 feet from the ground, against another pine; an accumulation of sticks and rubbish, suggesting a crude nest, had lodged in the top, which tempted me to give the tree a kick; much to my surprise a saw-whet owl flew out and alighted on a low branch of a pine within a few feet, where it sat and stared at me. I examined the fallen top carefully but could find nothing of interest; but I judged from the number of white droppings and pellets, on the ground below it, that this was the day roost of the male owl. There was probably a nest somewhere in the vicinity, but a protracted search failed to reveal it.

A different type of roost is described by Richard F. Miller (1923) as follows:

> On April 5, 1922, at Holmesburg, Philadelphia, Pa., while searching the upper border of a strip of woods, for a Cardinal's nest, I almost bumped my head against a Saw-whet Owl that was roosting under a dense canopy of honeysuckle vines, five feet high, that covered one of the bushes. The bird flew about fifteen feet and lit on a limb of a bush, a yard from the ground, with its back towards me. It permitted me to approach within two yards, turning the head around to watch me. It then flew about four yards and lit at the same height upon another bush. I approached within three yards before the bird flew to another perch, about ten yards away; both of these times it faced me and quietly and unconcernedly let me approach. It seemed utterly fearless, and gazed at me with wide opened eyes. Under its roost was a pile of 31 pellets, and two feet distant was a similar roost, under a dense canopy of Lonicera vines; beneath this one were 35 pellets, altogether 66 pellets beside pills of excrement, indicating that the bird had spent the winter here.

Except by some chance encounter, as related above, even the keenest human eyes are not likely to discover this diminutive owl, perched silent and motionless in dense foliage, unless its presence is indicated by the excited activity and noisy protests of its small bird enemies, such as sparrows, warblers, chickadees, and kinglets, that always show their hatred and fear of all owls.

Voice.—The far-famed saw-filing notes are far from being the only, or even the commonest, notes uttered by this versatile little owl. William Brewster (1925) has decribed several of these in his notes from Umbagog Lake, Maine. Of the saw-filing notes, he says: "They may be heard everywhere in the forest in February and March; oftenest just before daybreak, not infrequently throughout the night, occasionally in the daytime during cloudy weather when they are thought to presage rain. The saw-filing season reaches its height in March and usually ends before the first of May, although it may continue intermittently through that month and even into the first week of June." On May 18 "they were given at infrequent intervals and always in sets of threes thus:—*skreigh-àw, skreigh-àw, skreigh-àw.* Their general resemblance to the sounds produced by filing a large mill-saw was very close, I thought." On May 28, he heard a somewhat different, metallic note; the owl "kept it up for a little more than a minute, regularly uttering four apparently monosyllabic notes every five seconds. * * * Their metallic quality was so pronounced and their tone so ringing that they reminded me of the anvil-like *tang-tang-tang-ing* with which a species of Bell Bird makes the tropical forests of Trinidad resound. To this, indeed, they bore no slight resemblance, although much less resonant and far-reaching. Nor did they fail to suggest saw-filing also." The above notes were heard near mid-day, but, at 9 p. m. on June 4, one "was heard to uncommon advantage, not only because of his nearness, but also because the calm night air remained undisturbed by sounds other than those he produced. *Whurdle-whurdle-whurdle* he called long and uninterruptedly, in a whistling voice obviously quite devoid of ringing or even metallic quality, and very like that of the Glaucidium of Trinidad, but somewhat more guttural. All his utterances were rapidly delivered, evenly spaced, and precisely alike. They altogether failed to suggest the sound of saw-filing." One, circling about the camp on two evenings, September 26 and October 5, "uttered a single staccato whistle, not unlike the familiar *pheu* of Wilson's Thrush, but decidedly louder and clearer. This was repeated at intervals of half a minute or less for some time." This was then replaced "by a gasping and decidedly uncanny *ah-h-h* something like that of a Barred Owl, but feebler and less guttural." Another "gave in quick succession four whistles:—*hew-hew-hew-hew.*"

W. Leon Dawson (1903) says that the principal note he has heard "is a rasping, querulous *sa-a-a-a-ay*, repeated by old and young with precisely the same accent, and inaudible at any distance above a hundred feet." The young also make a hissing sound, which is probably a food call, and a bat-like squeaking; Mr. Brewster (1882b) says that this squeaking was discontinued shortly after molting, when it began a new, whistling cry; "this utterance consists of a series of five or six low, chuckling but nevertheless whistled calls, which remind one of that peculiar, drawling soliloquy sometimes indulged in by a dejected hen on a rainy day."

The courtship notes are referred to above. The interesting bell-like note, with its curious ventriloquial quality, so graphically described by Audubon (1840), is probably also a courtship call. Mr. Terrill tells me that the saw-filing note is "not much louder than the rasping song of the katydid, and in fact is almost as suggestive of a grasshopper as a bird; it might be described as *t-sch—whet-t.*"

Field marks.—The saw-whet owl is the smallest of our eastern owls, considerably smaller than the screech owl; it is, however, considerably larger than the pygmy owls. It differs from the screech owls in having a rounded head with no ear tufts. It might easily be confused with the much rarer Richardson's owl, which is only slightly larger, but it has a black instead of a yellow bill; it lacks the black rim of the facial disk, so prominent in Richardson's owl, and the top of its head is streaked, instead of spotted.

Fall.—The saw-whet owl has generally been recorded as a resident species, but it evidently migrates to some extent, or at least wanders widely, in fall. As with many other apparently resident species, the *species* may be present at all seasons in regions where the summer and winter ranges overlap, but there has been a general southward movement of *individuals*. W. E. Saunders (1907) and P. A. Taverner and B. H. Swales (1911) have shown evidence of a heavy migration of these owls in Ontario in 1906, as revealed by the disastrous effects of a severe storm. Taverner and Swales (1911) write:

> The first indication we received of any strong migratory movement in this species was when W. E. Saunders of London, Ont., received word from Mr. Tripp of Forest, Ont., of a migration disaster on the shores of Lake Huron, October 18, 1906. His investigation of this occurrence was reported in "The Auk." He discovered the shore of the lake in the vicinity of Port Franks covered with the water-washed bodies of birds that had been overwhelmed in a storm, likely while crossing the lake; and though he covered but a small portion of the affected territory and did not touch upon its worst part, he counted 1,845 dead birds in two miles of shore. Here was evidently a disaster that overcame a large movement of mixed migrants but the salient fact in this connection is, that he counted 24 Saw-whet Owls among the debris. Mr. Saunders is, and has been for the last twenty-five years, a most keen and enthusiastic field worker, but in summing up his experience with the species, says: "The Saw-whets were a surprise. They are rare in western Ontario, and one sees them only at intervals of many years, evidently they were migrating in considerable numbers."
>
> A statement elicited from the captain of the fish boat "Louise" of Sandusky, Ohio, bears very closely upon this subject. He says, that about October 10, 1903, when on the steamer "Helena", off Little Duck Island, Lake Huron, he saw a large migration of small owls and that many of them lit on the steamer. His description tallied very well with that of this species and there is the probability that it was a relay of this same migration that was so hardly used in 1906.
>
> In an adjacent and quite comparable station, Long Point, on Lake Erie and sixty miles to the east, we had heard that Saw-whets were at times captured in numbers by stretching old gill nets across the roads in the woods. The birds flying down the clear lanes became entangled in the meshes and thus caught.
>
> [While working through the red cedar thickets on this point, on October 15, 1910], within less than two hours, and in a small part of the thickets, we discovered twelve of these owls. We looked carefully for the young, the *albifrons* plumage, but without success.
>
> All birds seen were alert and the majority in the densest red cedar clumps. Most of them were close up against the trunk of their respective trees, and usually about six feet from the ground, the highest being about twelve feet, and the lowest four. None showed any fear. But one flushed, and that was only when the tree it was on was jarred in our passage; even then it flew but a few yards and allowed our close approach. None uttered any sound except the usual owlish snapping of the bill. * * *
>
> Here, then, are records of four migrational massings of this hitherto supposed resident owl. It was too early in the season to explain their gatherings as "winter wandering in search of food", and the close tallying of all the dates point to the conclusion that from the middle to the end of October the Saw-whet Owls migrate in considerable numbers, but from their nocturnal habits and secluded habitats while en route are seldom observed.

Winter.—When the weather is not too severe and the ground is not too deeply covered with snow, I believe that some of these little owls spend the winter as far north as northern New England. They seldom, if ever, I think, perish by freezing to death, if they can find sufficient food to keep up their vitality; but when the mice are all living in their tunnels under the snow, and most of the small birds have gone south, the poor owls are hard pressed for food, become very much weakened, and may succumb to the cold. Forbush (1927) writes:

> In winter in the great coniferous forests of Canada much of the snow is upheld on the branches of the trees in such a way that there are spaces here and there close to the trunks where there is little snow. There the wood mice come out at night from their hiding-places under the snow, and there the little owl perched in the branches above them awaits their coming; but if for any reason owl-food is scarce or hard to obtain, as sometimes happens in severe winters with deep snow, the little owls must move south or perish. At such times, as in the winter of 1922–23, when Acadian Owls were abundant in New England, there was a great influx of these birds from the north. By the time they reach a milder clime, many of them are too emaciated and exhausted to hunt or even to eat. They seem to lose all interest in life, and seek only a quiet retreat in which to die. Others more hardy or less exhausted survive to return, with the advent of spring, to the land of their nativity.

Bendire (1892) says:

> Mr. W. E. D. Scott took not less than twenty-one specimens during December 1878, in a cedar grove on a side hill with a southerly exposure, near Princeton, New Jersey. He found some of them very tame and unsuspicious, allowing themselves to be taken by hand; I have also found them equally stupid in the vicinity of Camp Harney, Oregon. Each winter one or more specimens were brought to me alive by some of my men, who found them sitting in the shrubbery bordering a little creek directly in the rear of their quarters, where they usually allowed themselves to be taken without making any effort to escape. I thought at first that they were possibly starved, and on that account too weak to fly, but on examination found them mostly in good condition and fairly fat. They seem to be especially fond of dense evergreen thickets in swampy places or near water courses.

It is hard to account for the large number of saw-whet owls that have been picked up dead in all sorts of places, unless this species is endowed with an especially delicate constitution, which requires an unusual amount of food. Even so, it seems hardly likely that they could have starved to death in the vicinity of Washington, D. C., where many have been picked up, or in the desert regions of California and Oklahoma, where their remains have been found, as the climate is mild and food available in all of these places. It may be, as Mr. Forbush has suggested above, that they were too far gone when they reached these places.

Mr. Terrill writes to me, from the Montreal region: "I have records for every month, but it is notable that I have recorded twice as many in December as in any other month. One must, of course, discount the suggested increase in December owing to the fact that some of them were seen in bare deciduous thickets. Nevertheless, there is undoubtedly a decided migratory movement of this owl in early winter, at least periodically, as they are frequently observed in places where I am satisfied they do not breed."

DISTRIBUTION

Range.—North America.

Breeding range.—The breeding range of the saw-whet owl extends **north** to southeastern Alaska (Forrester Island); central Alberta (Carvel, Red Deer, and Stony Plain); Saskatchewan (probably Osler and the Qu'Appelle Valley); Manitoba (Aweme and probably Kalevala); Ontario (probably Moose Factory); and Quebec (Lake Mistassini, probably Godbout, and Anticosti Island). **East** to Quebec (Anticosti Island, forks of the Cascapedia River, and the Magdalen Islands); Nova Scotia (Sydney, Pictou, Wolfville, and Halifax); Maine (Calais and Bucksport); New Hampshire (Tamworth and Franklin Falls); Massachusetts (Bridgewater, Taunton, and Wareham); Connecticut (Chester); New York (Millers); and western Maryland (Cumberland). **South** to Maryland (Cumberland); probably rarely northern Pennsylvania (Titusville); Ohio (probably Cleveland and probably Columbus); northern Indiana (Waterloo and Kentland); Illinois (probably Chicago); central Missouri (Bluffton); Nebraska (Nebraska City); Oklahoma (near Tulsa); probably Colorado (Dome Rock and Breckenridge); north-central Arizona (San Francisco Mountains); and southern California (San Gabriel Mountains). **West** to California (San Gabriel Mountains, Fyfee, and the South Fork Mountains); Oregon (Newport and Beaverton); Washington (Yakima and probably Owyhigh Lake); British Columbia (Chilliwack and Masset); and Alaska (Forrester Island).

Winter range.—The winter range of this little owl extends **north** to British Columbia (Okanagan); central Alberta (Glenevis, Mundare, and Flagstaff); Saskatchewan (Eastend and Osler); Manitoba (Minnedosa); southern Ontario (Listowel, Guelph, Algonquin Park, and Ottawa); and Quebec (Montreal and probably Anticosti Island). **East** to Quebec (probably Anticosti Island); New Brunswick (Scotch Lake and Oak Bay); Maine (Calais and Portland); Massachusetts (Ipswich, Boston, and Taunton); Rhode Island (Kingston); Long Island (Orient); and New Jersey (Princeton, Camden, and probably Cape May). **South** to New Jersey (probably Cape May); Maryland (Baltimore, Laurel, and College Park); the District of Columbia (Washington); Ohio (Medina and Sandusky); southern Illinois (rarely Mount Carmel and probably Anna); Missouri (St. Louis); Kansas (Manhattan); Colorado (Denver and Salida); rarely New Mexico (Santa Fe and Silver City); southern Arizona (Huachuca Mountains, and Pima County); and southern California (Big Creek). **West** to California (Big Creek, Quincy, Point Reyes, probably Sonoma, and Oakland); Oregon (Gardiner and The Dalles); Washington (Kiona, Seattle, and Bellingham); and British Columbia (Okanagan).

Migration.—The movements of the saw-whet owl are too erratic to be considered as true migration, and it will be observed that there is little difference in the breeding and wintering ranges outlined. Nevertheless, it is probable that in winter the individuals in the northern parts of the breeding range generally withdraw to the southward. Furthermore, during some winters the species becomes much more numerous in certain parts of its winter range. At such times a heavy autumnal flight may have preceded the concentration. Such flights usually take place in October but they are sometimes delayed until late in December.

In southern Ontario a large flight was recorded in the fall of 1889, again during the period October 10 to 28, 1895, and a third on October 10, 1906. On the latter occasion large numbers were killed by a storm while crossing Lake Huron.

The saw-whet is rarely seen in southern latitudes after the latter part of March.

Casual records.—There are a number of recorded instances of this species in regions that are outside of the normal range. Among these are the following:

One was seen at Lewisburg, W. Va., on December 24, 1914. In Virginia one was reported from Parksley on December 10, 1889; another was taken at Cowart on November 26, 1902; and a third was seen at Blacksburg in January 1912. A mounted specimen was exhibited at the fair at New Bern, N. C., in 1892; an adult female was collected at Raleigh, on December 18, 1894; and another was taken in Wake County, on December 4, 1897. South Carolina has at least four records—a specimen with incomplete data from St. Helena Island; one collected on November 11, 1909, at Weston; one taken at Aiken in February 1899; and one seen by Wayne at Mount Pleasant on December 24, 1885. A specimen taken on Tybee Island, Ga., January 1, 1911, was identified at the Biological Survey. One was collected at Madisonville, La., in December 1889.

Macoun lists the species as a "not uncommon summer migrant" in Newfoundland but gives no additional details. In Bermuda, on January 12, 1849, one was found sitting inside the muzzle of a gun and was kept alive for several days. Another was reported to have been seen in the same locality a short time afterward.

The status of the few saw-whets that have been reported from Mexico and Guatemala is somewhat uncertain, but they are considered a distinct race by some authors.

Egg dates.—New York and New England: 12 records, March 19 to July 3; 6 records, April 10 to 30, indicating the height of the season

Ontario to New Brunswick: 3 records, April 6 and May 23 and 28.

Washington and Oregon: 2 records, April 12 and May 2.

Oklahoma: 2 records, April 18 and May 3.

CRYPTOGLAUX ACADICA BROOKSI Fleming

QUEEN CHARLOTTE OWL

HABITS

A dark race of the saw-whet owl was first recognized and described by Dr. Wilfred H. Osgood (1901), and called the northwest saw-whet owl (*Nyctala acadica scotaea*); the type was collected at Massett, Queen Charlotte Island, British Columbia, on December 19, 1896. The characters given for it are: "Similar to *N. acadica*, but darker both above and below, dark markings everywhere heavier; flanks, legs, and feet more rufescent." He says further in regard to it: "This dark-colored form of the Acadian owl doubtless ranges throughout the humid Pacific coast region. * * * The only specimens that I have examined beside the type are several imperfect ones from Puget Sound, which are in the National Museum collection. These agree with the type in richness of color and extent of dark markings."

Ridgway (1914) treated *scotaea* as a synonym of *acadica*, after examining the type of the former and other material available, for he says:

> I am not able to make out any geographic variation in this species except a slight average difference in the hue of the brown of the upper and under parts, which is reddest in examples from the Pacific coast district (British Columbia to southern Mexico), more grayish brown in those from the Rocky Mountains, intermediate, but nearer the former, in those from the Atlantic side. * * * The only peculiarities that I am able to observe in the type of *Nyctala acadica scotæa* consist in the deep ochraceous-buff auricular region and more reddish brown of the pileum; but I am of the opinion that these characters will not prove constant when more specimens from the Queen Charlotte Islands have been examined.

The Queen Charlotte owl (*Cryptoglaux acadica brooksi*) was named and described by J. H. Fleming (1916), based on three adult females and one immature bird, taken on Graham Island, in the Queen Charlotte group, and sent to him by J. A. Munro; he also examined two more, one of them a male. These are all very much darker than Osgood's type of *scotaea*, in both sexes; for a detailed description the reader is referred to Mr. Fleming's paper. He suggests that the type of *scotaea* may have been a stray from the mainland, as it is very different from the birds he has described as *brooksi*, which probably represent the resident race of the islands. That there may be another race on the Pacific coast, of which *scotaea* is typical, is a possibility; but Mr. Ridgway failed to recognize it, and Mr. Fleming says that it "is only approached by a bird from Queretaro, Mexico, and is much brighter than a male from Victoria, B. C., which in turn can be matched by Ontario birds."

Nothing seems to be known about the nesting habits of this race; but we have no reason to think that, in these or other habits, it differs materially from the eastern race; its food and its plumage changes are apparently similar; the characters of the race are well emphasized in the juvenal plumage; its eggs are unknown, so far as I know.

OTUS ASIO NAEVIUS (Gmelin)

EASTERN SCREECH OWL

PLATES 61, 62

HABITS

Because the Linnaean name *Strix asio* was based on Catesby's "little owl" from South Carolina, our familiar screech owl of the northeastern United States has to be given the above new name, which is based on the name that Pennant gave to the "mottled owl" in his Arctic Zoology.

This species, as represented by its various races, is widely distributed from extreme southern Canada throughout practically the whole of the United States and well into Mexico. It is fairly common and well known throughout most of this range. As the eastern race enjoys the widest distribution and is the best known, it will be treated more fully than the other races, all of which are much alike in general habits.

Courtship.—Many of us have heard the tremulous and lugubrious wailings of the screech owl during the mating season, when this and other owls are most active in their vocal performances; but, because these demonstrations of affection are indulged in mainly during the hours of darkness, few of us have ever seen the birds in action. Dr. Lynds Jones was more fortunate, and wrote to Major Bendire (1892) as follows:

> I saw this species mating once. The female was perched in a dark leafy tree apparently oblivious of the presence of her mate, who made frantic efforts through a series of bowings, wing-raisings, and snappings to attract her attention. These antics were continued for some time, varied by hops from branch to branch near her, accompanied by that forlorn, almost despairing wink peculiar to this bird. Once or twice I thought I detected sounds of inward groanings, as he, beside himself with his unsuccessful approaches, sat in utter dejection. At last his mistress lowered her haughty head, looked at and approached him. I did not stay to see the sequel.

F. H. Carpenter (1883) had a pair of screech owls that raised a brood of young in captivity; he writes: "About the first of February, 1883, their actions towards each other began to change. Instead of snapping at one another for a bit of meat, I was surprised to see one of them take a bit of food and carry it to the other one that was perched on the topmost beam, which in turn gravely received it. * * * These attentions seemed to increase. They would sit as close together as possible, frequently preening each other's feathers. The male bird (I was sure of it by this time) would take a piece of meat and fly up with it to his companion, lay it down, and invite her to take it by a series of hops and bows."

P. T. Coolidge (1906) gives the following account of it:

> About ten or eleven minutes after sunset he left the tree and began singing his love song; he was now full of life and ignored all disturbance. His song was in B flat of the middle octave, a soft trill, seemingly far away, two or three seconds long, and closing with an upward inflection, as if the bird were asking a question,—as doubtless he was. Until the flight of the female, he sang from various perches, now from the branches of the elm, now from some neighboring tree, now from the rim of the cavity in the elm, his eyes fastened upon his quiet mate. His handsome head was continually bobbing and swinging. Once in a while the male would light beside her; flashing of wings would follow, but darkness made more exact analysis of their movements impossible. Occasionally he would fly out of sight. Returning from one of these trips he lighted upon the rim of the cavity and touched his bill to that of his mate, but whether to give her some tidbit, or merely a greeting, the darkness kept secret.

Nesting.—Although the screech owl is fairly common in my home territory, I have never examined many nests, as I have never made any special effort to find them. On only one occasion have I been able to flush one of these owls off the nest by rapping on the tree; had I taken the trouble to climb to and examine every likely looking hollow, I probably would have found many more. As it is, my notes contain the records of only seven nests. Three of these were in natural cavities in old apple trees in orchards; two were in dead pine trees, and one in a dead poplar, in what were apparently old flickers' holes; and the other was 35 feet from the ground, the highest I have ever found, in a natural cavity in a large oak on the edge of some woods. I found my first nest on May 18, 1889, while climbing to an osprey's nest on a dead pine stub in some mixed woods; the owl's nest was in an old flicker's hole below the osprey's nest and about 20 feet from the ground; the owl was sitting on a set of five eggs nearly ready to hatch, and had to be lifted off the eggs. On April 12, 1891, we found a pair of screech owls, a red and a gray bird, nesting in a natural cavity in an apple tree in an old orchard; the opening was only about 5 feet from the ground, so that we could look in and see both owls in the nest apparently sound asleep; under the red owl were five fresh eggs. After removing both owls, to inspect the nest, we returned the gray bird to the hollow, where it promptly settled down; the red one we threw up into the air; it dove straight for the hole, but missed it and fell to the ground, perhaps bewildered by the light and the rude awakening; but it soon recovered its wits and flew off to some nearby woods. On two other occasions I have found both of a pair of owls in the nest together, always one red and one gray.

Two other nests in old orchards were evidently successive nestings of the same pair of owls. The first was found on May 20, 1933, in a natural cavity in an apple tree, about 10 feet from the ground; it contained five young, partially clothed in the downy juvenal plumage, that were being brooded by a red adult; when I released her, she flew swiftly and easily to another apple tree and dove into a cavity. We explored this orchard thoroughly on April 19, 1934, but could find no trace of the owls; but in another old orchard, about 200 yards away, we were more fortunate. An upright branch, or fork of the main trunk, of an old apple tree had an open cavity, facing upward; looking downward into this we could see the gray owl clinging to the rough side of the cavity and sound asleep; about 30 inches below the open cavity was a knothole, barely large enough to admit my hand; this was only about 6 inches above the nest of leaves and rubbish, on which we could dimly see the red owl, sitting on her eggs, blinking and snapping her bill. I succeeded in relieving her of six, nearly fresh, eggs; she made no resistance, as I reached under her, but finally climbed up and clung to the side of the cavity below her mate (pl. 61).

All the above nests were in Bristol County, Mass. In most cases the eggs were laid on the rotten chips and other rubbish that the owls happened to find in the cavities; I believe that they never carry in any nesting material and that where such material is found it merely indicates that some other bird or mammal had brought it there previously. But the nests often contain a few feathers of the owls, or the feathers, fur, or other remains of their victims. Though I do not claim that it has any great significance, it is an interesting fact that it has always been the red bird, in a mixed pair, that I have found sitting on the eggs, or brooding the young.

The above nestings were apparently typical of the nesting habits of the screech owl in other sections. A. D. DuBois writes to me of a nest he found, about 50 feet from the ground in a large sycamore; the owl sat with its head out of the hole, watching him, until he climbed to within ten feet of the hole; this habit has been noted by others. Major Bendire (1892) says: "Mr. Oliver Davie mentions his having found several nests between the broken siding of ice houses along streams. Mr. C. S. Brimley found a set of three eggs of this species placed in a cavity of a stump, the bottom of which was below the level of the ground outside."

Screech owls have been known to nest in bird boxes, set up for that purpose on trees or buildings, and they would probably do so oftener if given more encouragement; a little sawdust or excelsior in the bottom of the box is quite to their liking. They have also nested in dove cots and in purple-martin houses, and not always to the injury of the rightful occupants, as the following experience, related by Ralph R. Wilson (1925) will show:

> During the winter of 1923–24 two Screech Owls took up their quarters in one of the roomy compartments of the largest nest-box. I was away that winter and the following spring, but when school closed (May 26) I returned and found ten

> Purple Martins nesting in the boxes. Three days later, at twilight, I saw a gray phase Screech Owl frequently alight at the entrance of a compartment of the largest nest-box and quickly fly away after a very noisy reception from within. I was surprised at this as Martins were nesting in all the other compartments.
>
> Investigation next day disclosed a husky young Screech Owl, apparently the last of a brood, in the box. It was observed that the Martins carefully avoided that compartment. Ten days later the Owl was gone and a pair of Martins at once built a nest in and occupied that part of the box.
>
> By June 30 the Martins were all scouring the air and feeding their young. That evening one parent Owl reappeared at the box. I scared it away but next day I noticed that the two Martins that nested where the Owl had nested were not feeding their young. A second inspection showed an empty nest.

The screech owl also has been known to nest frequently, even regularly, in cavities in trees close to houses in towns and cities, thus showing more confidence in human beings than most other owls show. I have had several such cases reported in my home city.

Eggs.—The screech owl lays three to seven eggs, but usually four or five, with the average in favor of five; the extremely large or small sets are rare; even as many as eight or nine have been reported, but these reports seem doubtful. Bendire (1892) says that they "are pure white in color, usually oval or nearly globular in shape, and moderately glossy. In the majority of specimens the shell is smooth and finely granulated, while in a few it is rough to the touch." The measurements of 56 eggs in the United States National Museum average 35.5 by 30 millimeters; the eggs showing the four extremes measure **38** by 31, 37.5 by **32, 32** by 29.5, and 33 by **28.5** millimeters.

Young.—The period of incubation is variously reported as from 21 to 30 days, but the average is probably around 26 days, as determined by the careful observations of Miss Althea R. Sherman (1911). As the eggs are laid at intervals of two or three days, sometimes at longer intervals, and as incubation may begin after the first egg is laid, or not until after two or three are laid, the exact period of incubation is difficult to figure.

Apparently the female does most, if not all, of the incubating and the brooding of the young. Miss Sherman (1911) describes the egg laying and incubation as follows:

> The first egg was found in the nest on the morning of March 27, and was still alone on the evening of the 29th. The following day the nest was not visited, the only day in two months and a half, when visits were omitted. No doubt the second egg was laid some time on the 30th of March; the third one was deposited on April 1, but two days intervening between the laying of the second and third eggs, while three or more days were the period between the other layings. The fourth egg was in the nest at half past four o'clock in the afternoon of April 4, but it was not there at eight o'clock on the previous evening. This shows that it took from eight to nine days to complete the clutch of four eggs. Whether the Owl laid in the night, or in the morning as other birds do, was not ascertained. * * * Constant incubation appears to have begun on the first day of April after which she was frightened out on two evenings. * * * Eggs No. 1 and

No. 2 were found to have hatched on April 27; No. 3 hatched the following night, and No. 4 about five o'clock in the afternoon of April 29, showing that the period of incubation was about twenty-six days.

Following are some of Miss Sherman's observations on the young:

This owl may have been called the Shivering Owl, because it shivers. It certainly shivers, that it screeches may be a question for dispute. This peculiarity is one of the early things to be observed in the life of these nestlings; but the shivering does not become very pronounced until the bird is two days old, and continues until it is about two weeks old, at which time the young owl is well covered with thick down: therefore it seems quite possible that it shivers because it is cold. * * *

Until the shivering period was past they sought the warmth found under the mother's wings; after this as one would naturally suspect, they as do other young birds, continued to sleep much, standing in a bunch with their heads pressed together; they preened themselves but not so much as do some nestlings; frequently they yawned, monstrous, big-mouthed yawns. Stretching was the favorite exercise, during it the birds seemed to be made of india-rubber. On May 16 the height to which one stretched itself was seven inches by actual measurement. * * *

During their nest life but three varieties of cries were heard from them, the first, beginning as soon as they were out of the shell, had some resemblance to the peep of a chicken, and was uttered by them when out from under the mother's wings, seemingly a cry for shelter and for food: this ceased when they were about three weeks old. At this age a second cry was heard for the first time, which had a decidedly squeaking sound and was made when they were squabbling for the warmest place in the family circle. The remaining cry, a sort of chatter, appeared to be the tone for a dinner discussion, friendly enough in quality, for they were never seen to quarrel at meals. Besides these there was the snapping of the bill which commenced the day they began to show fear, and a hissing sound made when they were frightened. * * *

The male Screech Owl appears to have been the general purveyor for the family. In the first fortnight of incubation there were nine mornings when an excess of food lay beside his mate; of this she rarely ate during the day, but there were times when she did so. On the remaining days of incubation she had food beside her twice, but as soon as the eggs commenced to hatch there was a superabundance provided. An example of this was furnished on April 29 when there lay in store four meadow mice weighing about two-fifths of a pound altogether. This excessive provision lasted only a few days, the supply decreased daily, and none was seen after May 15. Nine o'clock, half past nine, and ten o'clock were hours upon which he was known to have brought food to the nest, eight o'clock in the evening being the earliest time. * * *

Bits of flesh clipped from meadow mice in store, that were placed in the mouth of a nestling, were swallowed with some difficulty and no apparent relish. Their beaks were stained upon the outside with bloody matter, and as they grew older they would nibble at the mother's bill as if teasing for food. All these things led to a belief that in their earlier days they were fed predigested or partially predigested food, which they pulled from the beak of the mother. * * * On the tenth an owlet was seen for the first time pulling at food (the body of a frog), as if eating it. The next morning during observations the mother lifted her head from the corner and appeared to eject something from her mouth; at once the owlets scrambled to the spot and seemed to eat for a few minutes. * * *

Pellets ejected by the young were found for the first time on May 10; it may be well to note that this was the first date upon which they were seen eating the food that lay in the nest. A pellet disgorged on May 27 weighed sixty-two grains, which was one-thirtieth of the weight of the bird that ejected it.

Dr. Arthur A. Allen (1924) made a series of careful observations on the method of feeding a brood of young screech owls, which he confined in a cage in front of a blind, equipped with a lantern, flashlight, and camera. He writes:

> From the outset it was obvious that both parent birds were engaged in caring for the young. * * * They never both came together to feed but frequently when the flash light disturbed one bird before it had time to feed, the other would return with food and both would be near with food in their bills at the same time. The old birds were ordinarily silent in their hunting and feeding but the young birds, after they had been put in the cage, kept up a continuous humming during the night which lasted as long as they were hungry. If one of the young did not give the food call, the old birds paid no attention to him but fed the ones that called. The food was always brought in the bills of the old birds and placed directly into the mouths of the young. Large objects like birds or mice were often brought already partially torn or eaten or they were sometimes torn to pieces in front of the cage before being passed through the wire. Just as often, however, the entire bird was given to the young and they would fight among themselves for it. It was after one such tug-of-war that two of the young attacked the third and picked most of his bones by morning.

In order to determine the number of feedings, the amount of food, and its nature, George McNeill (Allen, 1924) remained in this blind nearly all night for seven successive nights, June 29 to July 6, inclusive. The earliest time at which feeding began was 8.25, and the latest was 9.12 p. m.; the earliest time at which feeding ceased was 2.50, and the latest was 4.15 a. m. The number of feedings was very variable, being 20, 73, 36, 14, 75, 67, and 72, respectively, on the seven nights. The most intensive feeding was on the night of July 4, when "the young Owls were first fed at 8.34 and between then and 1.40 were fed 75 times, two beetles and 73 moths. The birds then became quiet and as it was very chilly Mr. McNeill left. The next morning I gathered the feathers of six birds that had evidently been fed to the young after 1.40; Phoebe, Scarlet Tanager, Cedar Waxwing, Chipping Sparrow, Redstart, and Catbird."

From the above records it appears that from the time that the first egg is laid to the time that the young leave the nest about eight weeks have elapsed. Probably the young are watched over, and fed more or less, by their parents for five or six weeks more before they are turned away to shift for themselves.

Plumages.—When first hatched the young screech owl is covered with pure white down, even to the tips of its toes; it is very attractive at this age. Miss Sherman (1911) suggests:

> As they tumbled about in their nest they very forcibly suggested human babies in fleecy white cloaks that are learning to creep. Held in the hand with their beaks downward and out of sight they looked like diminutive blind kittens; perhaps the most noticeable thing about them at that age was their large heads. But this winning aspect of the nestlings was of short duration. In a few days the pin-

> feathers began to show in the white down which soon turned to a dirty gray color. By the time they were twelve days old they had become most repulsive, exceedingly filthy to handle with an appearance that was decidedly repellant. Perfect miniatures were they of a doddering, half witted old man; the blue beak was prominent and suggested a large hooked nose, while the down below it took the shape of a full gray beard, and that on the top of the head looked like the gray hair that covers a low, imbecile forehead; the eyes not fully open were bluish in color, and had a bleared and half-blind appearance. This loathsome semblance lasted no longer than ten days by which time the eyes were full and bright and yellow, the bird was covered with a thick gray down, and looked as if a facsimile of it could very easily be made from a bunch of gray wool devoid of any anatomy.

The above somewhat fanciful but graphic description gives a very good impression of what the young screech owl looks like in its early days. The last stage referred to is what I call the downy juvenal plumage. This secondary down, or, more properly, downy plumage, is acquired before the young bird is half grown and before the flight feathers have burst their sheaths. It replaces the first, or natal, down, the old adhering as white tips on the new. On the upper parts this downy plumage is basally pale "tawny-olive", or "Saccardo's umber", with grayish white tips, and barred with "sepia"; on the under parts it is grayish white and more narrowly barred with paler sepia. During this stage the two color phases begin to be distinguishable, the gray phase being grayish white and gray and the red phase more generally tinged with "pinkish cinnamon"; this difference becomes more pronounced as the flight feathers begin to develop. When the bird is about half grown the first winter plumage begins to show, first in the scapulars, then in the wings, and then in the tail; the bird is fully grown and the wings and tail are fully developed before there is much change in the body plumage; the molt of the body plumage occurs in July and August, beginning on the back, followed by the under parts, and lastly including the head.

This molt produces the first winter plumage, which is much like that of the adult, and is worn through the following spring and until the next summer molt, the first postnuptial. Young birds can be recognized in this plumage by the juvenal wings, tail, and scapulars; the wings lack the white on the outer webs of the primaries, which are broadly barred with "cinnamon" and dusky; and the broad white tips of the greater and median wing coverts and the white outer webs of the scapulars, so prominent in adults, are less pronounced in young birds; red adults have the central pair of rectrices nearly or quite clear red, and gray adults have them mottled; young birds of both phases have the central feathers more or less distinctly barred, and the lateral feathers more heavily barred with dusky. Adults apparently have one complete annual molt late in summer and in fall.

The screech owl gives us one of the best examples of dichromatism, apparently entirely independent of sex, age, or season, but shown to its perfection in only the eastern races; some of the western races show an occasional brownish phase; and an intermediate, brownish phase occurs rarely in the eastern races. Many years ago E. M. Hasbrouck (1893) made an extensive study of this subject, and published a paper based on the data obtained from 3,600 birds. He attempts to—

> show, first, that while the red, the gray and the intermediate phases are at present but individual variations of the same species—the gray was the ancestral stock; second, that the gray bird evolved the red, which at some future time will be a recognized sub-species with a range peculiar to itself, and thus dichromatism is one step in the evolution of the Screech Owl, while the various phases exhibited are the transitorial stages of development of one species from another; third, that this condition of affairs is influenced by four powerful factors (two of which temperature and humidity, are dominant powers in geographic distribution), the most potent of which is temperature; fourth, that the *predominating* distribution of the respective colors is largely confined to the faunal divisions of the Eastern United States, and as such is approaching the sub-specific differentiation of the two phases.

His five maps illustrate the ranges of the eastern races, the areas occupied by each one of the phases exclusively and those in which one of the phases predominates, and the distribution of the phases in comparison with temperature, humidity, and forest growths; the distribution of the phases seems to correlate fairly well with the distribution of these factors. He makes the statement that whereas the offspring of parents of two different phases, or of two red parents, may be all red, all gray, or of both colors, "not a single record can be found of the offspring of a pair of gray birds showing the slightest trace of red." This statement seems remarkable, but I have no evidence to the contrary.

Food.—The screech owl enjoys a varied bill of fare including almost every class of animal life. Dr. A. K. Fisher (1893b) summarizes its food as follows: "Of 255 stomachs examined, 1 contained poultry [pigeon]; 38, other birds; 91, mice; 11, other mammals; 2, lizards; 4, batrachians; 1, fish; 100, insects; 5, spiders; 9, crawfish; 7, miscellaneous; 2, scorpions; 2, earthworms; and 43 were empty." He says of their hunting methods: "At night-fall they begin their rounds, inspecting the vicinity of farm-houses, barns, and corncribs, making trips through the orchard and nurseries, gliding silently across the meadows or encircling the stacks of grain in search of mice and insects. Thousands upon thousands of mice of different kinds thus fall victims to their industry."

Dr. Paul L. Errington (1932c) says: "My Wisconsin record for Screech Owl vertebrate and large invertebrate prey totals up to 137 individuals, in the following proportions: Norway rat, 1; meadow mouse, 49; deer mouse, 37; shrew (*Blarina*, 6; *Sorex*, 1), 7; small bird (predominantly English Sparrow according to feather evidence of kills), 36; fish, 4; crayfish, 3."

Dr. Allen (1924) says: "To summarize: remains of birds were found on 35 days, insects on 28 days, crawfish on 24 days, amphibians on 15 days, mammals on 12 days, fish on 6 days, and spiders, snails, and reptiles on one day each." He gives a list of the species of birds fed to the young, making a total of 24 species and at least 98 individuals, and says: "Since the feathers in the nest undoubtedly represent many more than one bird of each species, the grand total of birds required to feed the three young Owls from the time of hatching until left by the old birds was certainly over a hundred."

The long list of items in the food of the screech owl includes the following mammals: Mainly mice of various species, but also shrews, rats, moles, flying squirrels, chipmunks, and an occasional bat. Illustrating the usefulness of the screech owl as a mouser, Forbush (1927) writes: "All one season I watched a pair that were rearing a brood near my cottage. * * * All the pellets and other refuse from their food that season showed only remains of mice, shrews and insects. * * * While the owls were there, the mice did no damage to our young orchard, but two years later their box fell down and was not replaced for the next two years. The second winter the mice girdled nearly all our apple trees. The next year a number of boxes were erected. The owls returned and we had no trouble from mice thereafter."

Although birds do not form so large a proportion of the food as mammals, the list of species is a long one, as follows: Domestic pigeons, quail, ruffed grouse, woodcock, sparrow hawk, screech owl, downy woodpecker, kingbird, phoebe, wood pewee, horned lark, blue jay, starling, blackbirds, Baltimore oriole, goldfinch, junco, canary, indigo bunting, English and various other sparrows, cedar waxwing, swallows, scarlet tanager, vireos, water thrush and various other warblers, house wren, chickadee, nuthatches, brown creeper, catbird, bluebird, robin, and various thrushes.

A farmer once brought to me a screech owl that had been living in his pigeon cote, and had killed nine of his pigeons; and there are several other similar records. I had one in captivity that broke into a cage and devoured a captive sparrow hawk; I could find only its feathers. Many young birds are taken from the nests of various small birds and fed to the young owls. Dr. Fisher (1893b) records a report of a screech owl, much emaciated and driven by hunger, attacking a large hen and attempting to carry it off. An instance of a screech owl killing a ruffed grouse is recorded by Dr. George M. Sutton (1927) as follows:

> At about midnight on December 20, 1924, Mr. George Ryder, of LeRoy, Bradford County, Pennsylvania, captured a Screech Owl in a steel trap which he had set earlier in the evening on the body of a grouse which he had just found freshly killed, and from which he had frightened what he recognized as a small

owl of some kind. Examination of the snow about the body of the grouse showed that no quadruped had caught the bird. Furthermore, the Screech Owl's stomach, which was examined at the writer's office, contained much of the head and neck of the grouse, as well as several sumac seeds, portions of rose-hips, and tiny twigs with buds attached, which must have been swallowed with the gizzard of the grouse. The owl was caught by both feet only a few minutes after the setting of the trap, so it is fair to assume that the eating had been done prior to the setting of the trap, probably just after the owl had killed its prey.

H. E. Tuttle (1920) says: "I came upon a Screech Owl one day, carrying what seemed to be a small kitten. I followed his line of flight, and as the burden proved too great a handicap for him in his effort to place a safe distance between us, he dropped it, but lingered near as if reluctant to yield it to my inspection. To my astonishment I discovered that it was an infant Owl, quite downy and quite dead."

Mrs. P. N. Jackson and G. Carleton (1931) write: "About two weeks ago, in Mendham, N. J., a Screech Owl came down the chimney of a house and ate up the Canary. * * * Feathers showed that the Canary had been pulled between the bars of the cage."

Screech owls feed quite extensively on insects; the list includes June beetles and other beetles, cutworms, grasshoppers, locusts, crickets, cicadas, katydids, noctuid moths, caterpillars, and hellgrammites. Many of these are caught on the wing. Dr. Sutton (1929b) watched a screech owl thus engaged, and writes:

> At first we were somewhat mystified by her actions. Soon we made out, however, that she was capturing insects which were flying about the peripheral twigs of the tree. Some of these she evidently snatched from the twigs or leaves with her feet; others she caught in mid-air, with her beak. Since I had never known Screech Owls to capture prey thus I changed my position so as to be able to see the bird more clearly. From my new station under the elm tree I saw the bird catch thus, Flycatcher-wise, at least twenty insects, most, if not all of them, the large beetles locally called June bugs or May beetles. We watched her for at least three quarters of an hour. She caught about two insects a minute, returning promptly to feed the noisy young. * * *
>
> This habit of capturing insects with the mouth, on the wing, instantly called to mind the characteristics common to the Orders Strigiformes and Caprimulgiformes. Birds of both Orders have soft, lax plumage permitting noiseless flight; both are at least to a degree, nocturnal, possessing relatively large eyes. The mouth of the Screech Owl, while hardly to be compared with that of the Whip-poor-will from the standpoint of size, is, nevertheless, relatively large or wide, and the hair-like feathers of the nasal portion of the facial disc probably perform the same insect catching function as the enormously developed rictal bristles of the Whip-poor-will.

Louis B. Kalter writes to me: "A screech owl practically snatched from my hands two male cecropia moths (*Samia cecropia*), around 4:30 a. m., when I was attempting to catch the moths with my hands. In the evening I had hung a live female cecropia moth, by means of a thread, in the open window of my bedroom. It had lured a number of males by its scent and, when I leaned from the window to catch them, a screech owl swooped down twice and caught them; once it came within 3 or 4 feet of my hands."

Mr. Forbush (1927) says: "Professor Aughey dissected 8 of these owls in Nebraska during locust invasions and in their stomachs found 219 locusts, 2757 other insects, 2 mice and 1 small bird. The one that had eaten the bird contained also 32 locusts and 8 other insects."

In addition to mammals, birds, and insects, the screech owl has been known to eat snakes, lizards, frogs, toads, various fishes, crayfishes, snails, salamanders, spiders, scorpions, millipeds, and earthworms. M. A. Frazar (1877) found in a screech owl's roosting hole sixteen horned pouts, four of which were alive; all the ponds in the vicinity were under 2 feet of snow and ice, but in one pond, fully a mile away, a hole had been cut in the ice by fishermen, where he inferred that the owl had caught the fish; this involved a total flight of 32 miles for the 16 fish.

With such an extensive and varied bill of fare, it is difficult to arrive at any general conclusion as to the economic status of this owl. It depends largely on its environment and the most readily available food supply, for this owl evidently is satisfied with what animal food it can most easily obtain. Where mice, rats, and and other small mammals are abundant, it apparently prefers them; in destroying them and in eating so many locusts, cutworms, and other noxious insects, it is decidedly beneficial. There are several cases on record, to its credit, where it has been useful in keeping in check, or driving away, an overabundance of English sparrows, which had become a nuisance in barns, hangars, and vine-clad houses.

But in a bird sanctuary a screech owl is an unwelcome guest. Miss Sherman (1911) found that her screech owls killed a great many small birds, especially juncos and song sparrows; all the latter disappeared in time; her verdict on the owls was that "their ravages were so great that it was decided if we desired a little bird paradise where all good birds were welcome through the summer time there Screech Owls could not be encouraged to remain."

Dr. Allen (1924) draws the following conclusions from his studies:

> A census of the birds nesting in the sanctuary in 1923 showed a slight increase in the total number rather than a decrease, though all species exterminated in 1922 failed to reappear in 1923. * * *
>
> There can be little doubt that the number of insects and small mammals destroyed by this pair of Owls could never compensate for the destruction of one tenth of the insectivorous birds eaten by the young. Though the Owls might spend the rest of the year feeding entirely upon insects and meadow mice, they could not possibly consume the equivalent of what would have been eaten by the 98 birds destroyed during the short space of eight weeks.
>
> From the data here presented it seems evident that the Screech Owl is a powerful factor in maintaining the balance of nature but, from the standpoint of increasing insectivorous birds, he is an equally powerful menace.

Dr. John B. May tells me that he had some young screech owls confined in a latticed shed. "Through the openings of the lattice nasturtium plants climbed, and I found that the owls ate considerable of the stems and leaves of these vines. Pellets composed of the woody fibers of the leaf stems were frequently found in the shed." Perhaps they needed the additional "roughage" in their food.

Behavior.—If the great horned owl can rightly be called a "feathered tiger", the screech owl deserves to be called a "feathered wildcat", for it certainly is a savage little brute, as some of the foregoing remarks on food indicate. Its courage in attacking birds much larger than itself is admirable, but cruelty and cannibalism are not so much admired. I once took a mated pair of these owls from a nest in which they were sitting on five eggs. The eggs went into a friend's collection, but I put the two owls in a cage by themselves in my aviary. I was surprised, a few days later, to find that one of them had killed and partially eaten its mate; I wondered if the loss of the eggs had anything to do with it. Fred. H. Carpenter (1883) says that his captive screech owl savagely attacked a long-eared owl which he put into the enclosure with it, so that it was necessary to separate the two birds. William Brewster (1907) published a thrilling story, on the authority of Mrs. John W. Ames, of Cambridge, of a pair of very aggressive screech owls that were raising a brood of young near a house in Concord, Mass. The occupants of the house were savagely attacked whenever they ventured near the trees where the owls were living after dark; even the neighbors were attacked when they passed the gate. People were repeatedly struck on the head and face, sometimes blood drawn, and this happened so often that they adopted the habit of wearing hoods or baseball masks when they went out in the evening. This was a rather extreme case of persistent hostility and boldness, but I have found in the literature no less than six somewhat similar accounts of screech owls attacking men, women, and children, in fancied defence of their young. This is apparently a common habit, but it oftener results in threats rather than actual injury to human beings.

The screech owl is one of our most strictly nocturnal owls. It does not hunt, and is said not to eat, during daylight Soon after dusk it sallies forth on its large, silent wings and glides swiftly along over the lowland fields and meadows in search of mice, or courses over the treetops to catch the larger flying insects. During the day it is inactive, dozing in some hollow tree, some dark corner, or huddled up close to the trunk of some densely foliaged tree; often, however, it will perch motionless all day in some opener situation, relying on its concealing pose and protective coloration to escape detection. Often it will sit for hours at the entrance to a hole in a tree, or some opening in a building, facing the bright sunlight. Its eyesight is strong enough, with the pupil fully dilated, to see well at night, but, with the pupil contracted, it can also see perfectly in the brightest daylight, though it seems confused when suddenly brought from darkness to sunlight. The only one I ever induced to leave its nest voluntarily in daylight flew perfectly and swiftly off through the woods for a long distance.

Captive owls that I have tethered in the open could see clearly every bird that flew across the sky and would follow them with the eyes until out of sight.

As with all owls, the screech owl's hearing is very acute and of great assistance to it in its midnight hunting. The rustling of a mouse in the dry leaves or grass, the stirring of a bird on its roost, the buzz or soft flutter of an insect's wings, or the splash of a fish in a dark pool, all serve to guide it to its prey. Likewise its keen ears often warn it of an approaching enemy. Probably its ears are fully as useful as its eyes at night.

Screech owls are ordinarily quiet, gentle birds; they can be lifted from their nests or roosting holes without offering any resistance; they may indulge in ominous bill snapping but seldom use their claws, which are sharp as needles. They make very good pets, provided they do not come in contact with other species, or even other individuals of their own species, which may result in tragedies; they love to be stroked or have their heads scratched; they are very cleanly, drink water freely, and are fond of bathing. Wild owls have been known to bathe in bird baths, often exhausting the supply.

Dr. Fisher (1893b) says: "Once about dusk the writer came upon a small family which had emerged the moment before from the water. They were sitting on some low alders over a shallow portion of the stream, ruffling up and shaking the water from their feathers, and presented a soaked and forlorn appearance. Apparently they were too wet to be able to fly well, for when approached they fluttered off heavily into the thicket and soon escaped from sight in the growing darkness. The number of times this Owl has been drowned in water barrels indicates its fondness for bathing."

W. I. Lyon (1922) had an interesting experience with one of these owls that was nesting in the same tree with a pair of flickers; the owl's eggs were destroyed, and for five consecutive days thereafter the owl was found in the flicker's nest, brooding the young flickers; the latter were regularly fed by their parents and were always uninjured; the owl had even brought in a small bird to feed to the young.

The screech owl is well aware of the concealing value of its well-known hiding pose; it will maintain this pose, even though closely approached, and remain immovable until it realizes that it is discovered; then a decided change takes place. The following extract from Owen Durfee's notes gives a very good idea of the whole performance: "I had the pleasure of finding two screech owls sitting side by side on a horizontal limb. The attitude was long drawn out, the whole body being stretched to its limit, the wings and feathers held as close to the body as possible. This gave them the appearance of two long stubs, the top of the head being nearly square across. The eyes were slanted slits, and while the head was directly toward me, the body was swung sideways so as to keep the wing in front as a shield; in other words, they were looking over their shoulders. In fact, one of them, as I walked part way around them, suddenly swung halfway around, so that it was looking at me over the other shoulder. After a few moments one of them evidently realized that it was discovered and underwent a sudden transformation; from a vertical position it quickly assumed a horizontal one, of only about one-half as great a height. It thus assumed a squatting position across the branch, the feathers being fluffed out, the head a round ball, the round eyes wide open, and with one click of the bill, it flew heavily away. A few moments later, the other bird followed in exactly the same line of performances."

Lewis O. Shelley writes to me: "As we were walking up a hill road we spied a screech owl, in gray phase, perched on a short limb tight up against the bare trunk of an ash tree. As we came into sight, very slowly the bird attained the protective pose of a dead stub. We approached to within 12 feet, waved our arms, called and even tossed pebbles. But the bird was fain to move as it sat, eyes half closed, in the warm sun. We each had an orange and were debating tossing them up at the bird. But the instant we drew them forth and the sun struck them, emphasizing their golden color, the bird quickly resumed its normal attitude, edged along the limb and, spreading its wings, noiselessly swept away."

Voice.—The name of this owl is somewhat unfortunate, as it very seldom indulges in anything that can rightly be called a screech. Mr. Forbush (1927) heard such a note from only one individual, of which he says: "It resembled the note of the siren whistle, beginning low and full and gradually rising without the usual tremolo until it ended in a shrill shriek."

Francis H. Allen has given me his description of two of the notes: (1) "the well-known wail, or whinny, the so-called love song, consisting of a succession of short, even, low notes delivered with varying degrees of rapidity. It also varies in pitch. Sometimes the first part is slow and the latter part rapid, virtually a trill"; (2) "*wheeoo*, a mellow whistle with a falling inflection, often followed by three shorter notes, each a very little higher in pitch than the preceding note—*wheeoo, woo, woo, woo.*"

I am tempted to quote Thoreau's (Langille, 1884) graphic description of the love song; he says: "It is no honest and blunt *tu-whit, tu-who* of the poets, but, without jesting, a most solemn, graveyard ditty, the mutual consolations of suicide lovers remembering the pangs and the delights of supernal love in the infernal groves. * * * *Oh-o-o-o-o that I had never been bor-r-r-r-n* sighs one on this side of the pond, and circles with the restlessness of despair to some new perch on the gray oaks. Then—*that I never had been bor-r-r-r-n* echoes another on the further side with tremulous sincerity, and *bor-r-r-r-n* comes faintly from far in Lincoln woods."

The screech owl's call is seldom heard until after dark, but Mr. Kalter tells me that he has heard it calling on at least three occasions in bright daylight, at 11.30 a. m. and 1.15 and 2 p. m. On two occasions he has heard one calling while in flight, once while being chased by a robin. Dr. Winsor M. Tyler contributes the following good description of the screech owl's notes:

"The commonest note of the screech owl is a whistle, well within human range, which, rising a little in pitch, becomes tremulous, then slides down below the starting point, the tremulous quality becoming so marked that, near the end, the voice is almost divided into separate notes. The whole has a sad, dreary effect, due rather to the tone of voice and the sliding change of pitch than to any minor intervals.

"The owl varies this cry in several ways. The note may begin on various pitches—that is, one wail may be markedly higher or lower than the wail preceding it; the pitch may rise very little, or it may rise two or more tones before it falls at the end; the pitch may fall a varying degree, sometimes three or four tones; and a fourth variation is at the beginning of the cry when the quavering quality is delayed appreciably.

"A second note, less common than the wail in proportion of about 1 to 10, may be suggested by the letters *ho-ho-ho-ho*, pronounced with a good deal of aspirate quality. This series of notes is generally given alone, but it may sometimes immediately follow the wail. The pitch of this call is about five tones below the highest note of the wail, and as a rule does not vary, although it occasionally runs upward a little. It is sometimes heard in the daytime.

"I have often heard another note in August and early in September, when several owls—presumably a family out hunting—had gathered 'in the dead vast and middle of the night' and were calling to one another from the trees about Lexington Common. Among the subdued whinnyings and tremulous owlish coos, there comes out of the darkness a sharp cry—almost human, or like a little child's voice—a cry like *keerr*, sometimes rolling at the end. It is about as long as a flicker's call note, and moves about as the bird flies from one perch to another. Sometimes the note is uttered with so much energy that it suggests excitement or eagerness.

"It seems probable that this is the call of a fledgling owl, signaling its whereabouts to its parents while they are away, searching for food among the branches of the trees, or on the grass underneath. On one occasion, when the owls were about the house, at 1 o'clock in the morning, I heard the shriek of a robin burst out of the night."

Field marks.—A small owl, with yellow eyes and prominent ear-tufts, is quite likely to be a screech owl, as the long-eared owl is considerably larger and slenderer. It is very seldom seen on the wing in the daytime, unless driven from cover. The bright reddish-brown color of the upper parts in the red phase is quite distinctive; no other North American owl has any color approaching this. In the gray phase it is much grayer than the long-eared, and very much shorter and stouter. In the gray phase the color pattern resembles the rough bark of an old tree, and the hiding pose, described above, increases the resemblance in the attitude in which the bird is oftenest seen in the daytime.

Enemies.—The larger owls and occasionally some of the larger hawks have been known to kill the screech owl; prowling cats or other predatory animals may pounce on one while it is securing its prey on the ground. Its less dangerous, but far more annoying, enemies are the crows, blue jays, and other small birds, which never lose an opportunity to pester, scold, and annoy one of these little owls when they can find it sleeping peacefully. The location of an owl can often be detected by the presence of a noisy mob of small birds, flitting about, chirping, and shrieking at the enemy they rightly fear and detest, but seldom daring to venture too near. The owl may stand this abuse with stolid indifference for some time but may be driven eventually to seek seclusion in some dark hollow. I once followed up a noisy mob of blue jays in a dense thicket and shot one of them, as I wanted a specimen; when I picked it up, I was surprised to find a dead screech owl lying near it, which I had killed unexpectedly. Many screech owls have been found dead along the much-traveled highways, apparently killed by automobiles.

Winter.—Screech owls are supposed to be permanent residents throughout their range, but probably some migration takes place from the northern portion of their summer range. They certainly wander about more in search of food in winter, as they are often seen at that season in places where they are not found in summer. The scarcity of food in the northern woods when the ground is covered with deep snow drives them to more fruitful hunting grounds about farms and even into towns and cities, where they find plenty of mice, rats, and English sparrows, as well as dark and secluded nooks in which to find shelter, about farmhouses, barns, corncribs, and outbuildings. Many of these owls have been found in winter in a sadly emaciated condition, which indicates that they have been driven by hunger from some less hospitable region.

OTUS ASIO ASIO (Linnaeus)

SOUTHERN SCREECH OWL

HABITS

The separation of this race from the other two eastern races of the screech owls was suggested by Outram Bangs (1930), and the suggestion was followed in the 1931 Check-List. He gives as the range of this race: "In the east from Georgia north to Virginia, and west to western Tennessee, southern Illinois, southeastern Kansas, Oklahoma, Arkansas, Louisiana, etc. Intergradation in the east takes place gradually in the region lying between Virginia and New Jersey." He shows clearly that the birds from this intermediate region are smaller than *naevius* and larger than *floridanus*, as might be expected. But his remarks on the color characters are not so convincing. He gives as the color characters of *naevius:* "Under parts in both phases, the red and the gray, coarsely marked with much white intermixed and with a large area of plain white in the middle of the belly." Of *floridanus* he says: "In markings, standing off sharply from the other two forms, in that the under parts are much more heavily and finely penciled with less intermixture of white and with less white in middle of belly." He claims for his proposed race, *O. a. asio,* that it is "in color and markings quite the same as *O. a. naevius.*" Then he admits that "two birds from Georgia (Broro Neck and Sapelo Island) are somewhat intermediate in color, but are larger than in *floridanus* and one bird out of six from southern South Carolina, though much larger than Florida examples, somewhat resembles them in markings."

It seems to me that he has shown conclusively that his proposed race is strictly intermediate in size, and, at least partially, intermediate in coloration. Neither the northern nor the southern race is anywhere nearly uniform, or constant, in coloration; there is great individual variation, as I have noted in the same series that Mr. Bangs examined. As to size, it is a well known fact that in this and other species there is gradual reduction in size from the largest northern birds to the smallest southern birds; halfway between these two extremes would seem to be the logical place to divide the species into *two* subspecies; if we name three subspecies there is no reason why we should not subsequently name two more, and so on indefinitely. As I do not think it wise to recognize intermediates in nomenclature, I prefer Mr. Ridgway's treatment of the case. He (1914) recognizes no difference, worthy of recognition in nomenclature, between *asio* and *floridanus* as differentiated by Mr. Bangs; and he includes under the name of Florida screech owl (*Otus asio asio*) all the birds included in the two more southern races suggested by Mr. Bangs.

Nesting.—The nesting habits of this owl are apparently no different from those of the other eastern races. Francis M. Weston has sent me the following note on a late nesting record, received from Mrs. W. H. Edwards, of Fairhope, Ala.: "Mrs. Edwards writes that one of her pupils, who was familiar with the screech owl, had found a nest of eggs in an old flicker hole some time late in the summer of 1929. The boy visited the place again on October 15, 1929, and found the young well developed and apparently ready to fly; and when Mrs. Edwards accompanied him there a few days later, to band the young birds, they had gone."

Behavior.—Helen M. Edwards (1932), presumably the Mrs. Edwards referred to above, tells an interesting story of the successful taming of a screech owl by Mrs. Julian Dyer, of Fairhope, Ala. The young owl was taken from the nest when a week old, on July 19, 1930, and banded. She kept the owl all through the following winter, when it became quite tame and very friendly. When mating time came, in spring, she released it and it flew away. "A few nights later" the owl returned, and since then it "has returned to the yard two or three times a week." Mrs. Dyer says that the bird often "enters during the night (her bedroom window being unscreened). The click of the aluminum band on her foot announces the bird's presence as she lights on the back of a chair. * * * At the time of writing (November 19, 1931)" the owl was "still paying regular visits to her human friends."

Voice.—Edward H. Forbush (1927) writes: "The little Screech Owl of the south is known in Louisiana as the 'Shivering Owl'; and along Bayou Lafourche when its notes banish sleep, and the resourceful 'Cajun' wishes to ward off the ills that he believes otherwise sure to follow, he must arise from his couch and turn his left shoe upside down. Then the cries are supposed to be stilled. This charm does not work, however, on the lower Mississippi, where one must turn his left trouser or 'pants' pocket inside out."

DISTRIBUTION

Range.—North America from southeastern Alaska and southern Canada south to northern Mexico; nonmigratory.

The range of the screech owl extends **north** to southeastern Alaska (Sitka); southern British Columbia (Chilliwack, Penticton, Okanagan, and probably Sicamous); probably southern Saskatchewan (Eastend and rarely Regina); Manitoba (Whitewater Lake and Aweme); North Dakota (Fargo); Minnesota (Crookston, Elk River, and St. Paul); Wisconsin (La Crosse and Kelleybrook); Michigan (Newberry, Neebish Island, and Douglas Lake); southern Ontario (Port Sydney and Ottawa); southern Quebec (possibly Beauport and Montreal); Maine (Dover and Calais); and probably New Brunswick (Grand Manan). **East** to probably New Brunswick (Grand Manan); Maine

(Bucksport and Norway); Massachusetts (Gloucester, Boston, Taunton, Woods Hole, and Marthas Vineyard); Long Island, N. Y. (Orient, Shelter Island, and Mastic); New Jersey (Red Bank and Sea Isle City); Maryland (Easton and probably Cambridge); Virginia (Camp Lee and Lawrenceville); North Carolina (probably Sans Souci, Raleigh, and probably Cape Fear); South Carolina (Columbia, probably Aiken, and Ladies Island); Georgia (Savannah, Riceboro, Blackbeard Island, McIntosh, and St. Marys); and Florida (San Mateo, Enterprise, Titusville, Fort Drum, Lake Worth, Coconut Grove, and Upper Matecumbe Key). **South** to Florida (Upper Matecumbe Key, Fort Myers, Manatee, St. Marks, and Whitfield); southern Alabama (Fairhope); southern Mississippi (probably Bay St. Louis); Louisiana (New Orleans, Houma, and Baldwin); southern Texas (probably Cuero, Corpus Christi, and Brownsville); Tamaulipas (Matamoros, Rio Martinez, and Ciudad Victoria); Guanajuato (Guanajuato); Durango (Rio Sestin); and Baja California (Cape San Lucas). **West** to Baja California (Cape San Lucas, San Ignacio, Rosario, El Sauz, Sierra de la Laguna, Villacares, and Rancho Viejo); California (San Diego, San Pasqual, Riverside, Los Angeles, Santa Barbara, Paso Robles, Monterey, Santa Cruz, San Francisco, Nicasio, probably Mount St. Helena, Mount Sanhedrin, and Eureka); Oregon (Waldo, Grants Pass, Corvallis, Salem, and Garibaldi); Washington (Cape Disappointment, Raymond, and Olympia); British Columbia (Victoria and Porcher Island); and Alaska (Sitka).

The range as above outlined is for the entire species, which has been, however, divided into several geographic races, most of which are accorded recognition by all reviewers. A few are still of uncertain status, being held to be valid by some systematic ornithologists and invalid by others. The 1931 edition of the A. O. U. Check-List recognizes 15 subspecies as follows, the ranges in some cases being somewhat amended: The eastern screech owl (*Otus asio naevius*), ranging from New Brunswick, Ontario, Minnesota, and southern Manitoba south to the uplands of Georgia, Alabama, northern Arkansas, and eastern Oklahoma; the southern screech owl (*O. a. asio*), occupying the Lower Austral Zone from Virginia to Georgia and the Gulf States, west to Louisiana, and north through the Mississippi Valley to southern Illinois, southeastern Kansas, Oklahoma, and casually Colorado; the Florida screech owl (*O. a. floridanus*), occurring only in the peninsula of Florida; the Texas screech owl (*O. a. mccalli*), ranging south from Bexar and Cowal Counties, Tex., to Tamaulipas and Nuevo Leon, Mexico; Hasbrouck's screech owl (*O. a. hasbroucki*), occurring in central Texas in Palo Pinto, Dallas, Kerr, Kendall, and Travis Counties; Aiken's screech owl (*O. a. aikeni*), foothills and plains of eastern Colorado, Kansas, Arkansas, and Nebraska, north to northeastern North Dakota, southern Manitoba, and northwestern Minnesota, and south to New Mexico; the Rocky Mountain screech owl (*O. a. maxwelliae*), ranging through the foothills and adjacent plains of the eastern Rocky Mountains from Saskatchewan and Montana south to central Colorado; MacFarlane's screech owl (*O. a. macfarlanei*), occupying the interior of southern British Columbia south to northeastern California, Idaho, and western Montana; Kennicott's screech owl (*O. a. kennicotti*), occurring in the northwest coast region from Sitka, Alaska, south to Washington; Brewster's screech owl (*O. a. brewsteri*), found in southwestern Washington, Oregon, south to Humboldt County, Calif.; the California screech owl (*O. a. bendirei*), occupying the coast district of California from the northwestern part south to the region of San Francisco Bay; the Pasadena screech owl (*O. a. quercinus*), the western slope of the Sierra Nevada south of Mount Shasta, southern California west of the desert areas, and the Pacific side of Baja California south to latitude 30°30′ N.; the Mexican screech owl (*O. a. cineraceus*), occurring in Baja California and Sonora, north to central Arizona, southern New Mexico and central western Texas; the saguaro screech owl (*O. a. gilmani*), found in the Lower Austral Zone of southern Arizona, the Imperial Valley of California, and northeastern Baja California; and Xantus's screech owl (*O. a. xantusi*), which occupies a restricted range in the Cape region of Baja California.

Migration.—There is no indication that screech owls perform any regular seasonal migrations, and they are, in fact, one of the most sedentary of all owls. This is abundantly demonstrated by the records of those that have been banded and subsequently recovered. With few exceptions points of banding and recovery are in the same immediate area. One banded on Staten Island, N. Y., on October 27, 1925, was recaptured at nearly the same spot, eight years later, on July 11, 1933.

The Biological Survey files contain only two records of banded screech owls that show travels of considerable length. One of these birds was banded at Ashton, Iowa, on December 16, 1928, and was recovered in January 1930 at Tabor, S. Dak., nearly 100 miles northeast. The other was banded at Glenwood, Minn., on March 25, 1932, and was retaken on December 20, 1932, about 200 miles to the southwest at Emmetsburg, Iowa.

Casual records.—According to MacSwain (1908) the species has occurred once on Prince Edward Island. On June 27, 1899, Osgood saw a small "reddish-brown owl" thought to be this species at Caribou Crossing, Yukon Territory.

There are two doubtful and incomplete records reported for England. One is said to have been taken at Kirkstall Abbey, Yorkshire, in 1852, and another at an unknown date near Yarmouth.

Egg dates.—New York and New England: 25 records, April 12 to May 18; 13 records, April 15 to 27, indicating the height of the season.

Pennsylvania and New Jersey: 53 records, March 23 to May 18; 27 records, April 7 to 21.

Florida: 37 records, March 11 to May 18; 19 records, April 4 to 18.

Illinois to Iowa: 16 records, March 29 to May 11; 8 records, April 9 to 24.

Colorado and Kansas: 33 records, March 13 to May 19; 17 records, April 7 to 24.

Arizona and New Mexico: 7 records, March 26 to June 6.

British Columbia to Oregon: 46 records, March 26 to July 13; 23 records, April 15 to May 7.

California: 127 records, March 7 to June 5; 64 records, April 7 to May 3.

Texas and Mexico: 48 records, February 27 to May 25; 24 records, April 5 to 30.

Baja California: 13 records, April 10 to May 20; 7 records, April 18 to May 15.

OTUS ASIO FLORIDANUS (Ridgway)

FLORIDA SCREECH OWL

PLATES 63, 64

HABITS

According to the 1931 Check-List, this subspecies is now restricted to peninsular Florida, the typical race (*Otus asio asio*) being assigned to the South Atlantic and Gulf States formerly included in the range of *floridanus*. Ridgway (Baird, Brewer, and Ridgway, 1905) describes this race as "similar to var. *asio*, (what we now call *naevius*) but much smaller, and the colors deeper. The gray stage very similar to that of var. *asio*, but the red phase very appreciably different, in there being a greater amount of rufous on the lower parts, the breast being nearly uniformly colored, and the rufous broken elsewhere into transverse broad bars, connected along the shaft."

Nesting.—On April 24, 1902, I found my first nest of this subspecies in a palmetto grove, close to the cottage where we were staying, at Oak Lodge, in Brevard County, Fla. It was in an old woodpecker's hole, about 18 inches deep and about 18 feet from the ground in a dead cabbage palmetto. The female was sitting on three heavily incubated eggs (pl. 64).

Another nest, found on April 1, 1925, at Gulfport, Pinellas County, was in an entirely different situation; it was in an old flicker's hole only 10 feet from the ground in a palmetto stub, in an open meadow, far from any cover; it held three fresh eggs and the parent bird.

On April 26, 1925, while driving through Pasco County, we stopped to explore several tracts of burned-over pinewoods, looking for sparrow hawks' nests. Flickers and red-headed woodpeckers were very common here, and there were plenty of their old holes in the charred pine stumps; three of the holes that we examined were all occupied by Florida screech owls, all with young of various ages.

Francis M. Weston sent me a photograph of one of two very low nests that he found in an open meadow near Pensacola (pl. 64). They were in stumps that "were left from medium sized cypresses (*Taxodium ascendens*) that had been sawed down, and the nests in both were made in hollows of decayed limbs less than 3 feet from the ground. There was no cover of any kind within 100 yards."

Dr. William L. Ralph (Bendire, 1892) says:

> They are not at all particular as to the height at which they nest. I have found them occupying holes anywhere from 8 to 80 feet from the ground. They nest frequently in rotten stumps at such heights as to make it dangerous, if not impossible, to reach them. I remember one pair that nested near the house where I boarded, in a hole at least 80 feet above the ground, near the top of a very large rotten stump which towered above the tops of a clump of trees among which it was standing. Every time during the breeding seasons of two years that I would go near this stump one of the pair, whichever might be sitting, would look out of the hole in a most provoking manner, for I wanted a set of eggs of this subspecies very much at that time, but the stump was not climbable. Usually it is a hard matter to make these birds show themselves; this pair, however, seemed to know that they were perfectly safe, and never hesitated to make their appearance.

Harold H. Bailey (1932) writes: "This season there has been called to my attention, two instances where these little owls have reared families inside houses, on top of the ceiling, access to which was through ventilator tiles."

Eggs.—The Florida screech owl lays two to four eggs; three is the usual number, and two is commoner than four. The eggs are like those of other screech owls, but they average smaller than those of the more northern races. The measurements of 57 eggs average 33.7 by 28.8 millimeters; the eggs showing the four extremes measure **36.8** by 27.7, 35.1 by **30.9, 30** by 28.2, and 33 by **26** millimeters.

Plumages.—The plumage changes are the same as in the eastern screech owl, and the red and gray phases are fully as pronounced; the red phase is even redder, especially on the under parts; there is also an intermediate or brownish phase.

Food.—This screech owl lives on much the same kind of food as others of the species, various small mammals, insects, and probably some small birds. J. F. Menge (Bendire, 1892) says: "They feed their young to a great extent on lizards and grasshoppers." Harold H. Bailey (1922) tells of a road, north of Miami Beach, on the west side of which "is the home of several species of mice, marsh rabbit, cotton tail, and the wood and water rats." On the other side is "a rank growth of beautiful tall sea oat." He says: "Often during the daytime while travelling this stretch of road, I have seen all the above mentioned mammals cross the road toward the beach. At night, however, there must be a regular migration of mammals across the road to feed on the wild oats. Travelling up this stretch of roadway during warm summer nights, I have in one trip, seen with the aid of my spotlight, and by flashing on my bright headlights quickly, as many as twenty Florida Screech Owls and Florida Burrowing Owls sitting in the roadway catching these mammals that pass back and forth across this open stretch."

OTUS ASIO MCCALLI (Cassin)

TEXAS SCREECH OWL

HABITS

The above name is now restricted to the screech owls of southern Texas, north to Bexar and Comal Counties, west to Kinney County, and south to Tamaulipas and Nuevo Leon, Mexico. Formerly, under the name of western mottled owl (*Scops maccalli*), its range was supposed to extend through Texas to Arizona and New Mexico. More recently other races have been described, restricting it to its present range. Ridgway (1914) describes it as "larger than *O. a. asio*, but smaller than *O. a. naevius* and paler than either; gray phase much more coarsely mottled above than in any other form of the species, the lighter spots and mottlings decidedly more conspicuous; rufous phase paler than that of *O. a. asio*, with rufous predominating on under parts."

I have never seen this subspecies, and very little has been published on it in its restricted habitat. Herbert W. Brandt says in his notes: "The only place we met with this interesting little fellow was along the railroads, where he spends the day in the telegraph poles, which have been literally honeycombed with golden-fronted woodpecker holes. As many as 18 holes of varying depths were seen in a single pole, starting from the ground and going up to the top. All new poles today are treated with a heavy coating of creosote, to which the woodpeckers do not take kindly, which means that the screech owls will soon have to return to their primitive abodes."

Nesting.—Referring to his explorations on the Lower Rio Grande, George B. Sennett (1878) writes: "On April 23d, while on the side of a gully in the edge of a woods, I flushed a bird of this species from its nest above my head. * * * The nest contained three perfectly fresh eggs, was situated about ten feet from the ground in a dead stub about nine inches in diameter, and so weak and rotten that I could have pushed it over."

Dr. James C. Merrill (1878) says: "Near Hidalgo, on May 6, 1876, I captured a female of this race on her nest in an old hollow stump about five feet from the ground. There were two eggs, nearly hatched, placed on a few chips at the bottom of the hole."

Eggs.—Major Bendire (1892) says that this owl lays two to five eggs, that they "are similar in every respect to those of the common form, excepting that they are a trifle smaller", and that "the average measurement of twelve specimens of this race in the U. S. National Museum collection is 33.5 by 29 millimetres, the largest egg measuring 35.5 by 30, the smallest 32.5 by 28 millimetres."

The measurements of 43 eggs average 33.9 by 29.2 millimeters; the eggs showing the four extremes measure **39.4** by 29.2, 38.1 by **32.3, 30.7** by 27.2, and 35.1 by **25.4** millimeters.

OTUS ASIO BENDIREI (Brewster)

CALIFORNIA SCREECH OWL

HABITS

When William Brewster (1882a) named this race, he gave as its characters:

> Above essentially similar to *asio* in its gray dress. Beneath ashy-white, everywhere thickly barred and streaked with black; the transverse bars being fine, numerous and regular, the shaft-stripes coarse and generally distributed from the throat to the crissum, both markings occurring as thickly on the median line of the breast and abdomen as along their sides. * * * The chief difference is in the ground-color and markings of the plumage beneath. In *asio* the central line of the breast and abdomen is nearly always immaculate, while there is frequently a broad, entirely unspotted gular space: in *bendirei* these parts are as thickly barred and streaked as are the sides, while the ashy tinge of the entire lower surface and the much finer character of the transverse pencilling gives the plumage a clouded appearance which, although difficult of description, is very characteristic. The ear-tufts, also, are usually shorter than those of *S. asio*.

This race inhabits the coast region of California, from near the Oregon line, where it intergrades with *brewsteri*, to the San Francisco Bay region.

Nesting.—The nesting habits of the California screech owl are essentially similar to those of other screech owls. Mrs. Irene G. Wheelock (1904) found one nesting in a red-shafted flicker's nest, sitting on three eggs of the flicker and two of the owl's. The flicker's eggs disappeared entirely, but the owl hatched out her own eggs. Mrs. Florence A. Sumner (1933) reports finding a brood of four sparrow hawks and one screech owl, which were all reared successfully by the hawks, in the same nest.

W. Otto Emerson (1885) succeeded in getting a pair of these owls to nest in a starch box, with some leaves and sawdust in the bottom of it, which he had nailed up on a tree in a grove. He adds further: "I found one the past Spring that had taken up quarters in an old wood rat's nest placed on a limb of a Bay tree, some thirty feet from the ground. A large mass of dead leaves from the tree had been put together, and a hollow formed in the centre, lined with feathers of fowls and birds."

Eggs.—The California screech owl lays three to five eggs, which are like those of the eastern screech owl but average slightly smaller. The measurements of 45 eggs average 34.8 by 29.9 millimeters; the eggs showing the four extremes measure **38** by 28, 36 by **32,** and **32** by **28** millimeters.

Plumages.—Dr. Louis B. Bishop, who has good series of all the different California races of the screech owl, tells me that they all have two color phases, a brown and a gray one, but no red phase as in the eastern bird.

Food.—The California screech owl is apparently rather more beneficial than otherwise in its food habits. Where English sparrows are numerous it seems to show a decided preference for them. In a nest in a large oak on the University of California campus, Ernest D. Clabaugh (1926) found as many as six English sparrows in the nest at one time, and others on three other occasions; he also found wing feathers of birds, mostly sparrows of different species, feathers of a California jay, a pocket gopher, meadow mice, a salamander, and a large beetle. One of the young, which had been injured by a fall, was apparently eaten by its nest mates.

OTUS ASIO KENNICOTTI (Elliot)

KENNICOTT'S SCREECH OWL

PLATE 65

HABITS

This large, dark-colored screech owl is found in the humid, northwest-coast region, from Sitka, Alaska, to northwestern Washington. Ridgway (1914) describes it as: "Large, like *O. a. macfarlanei,* but coloration much darker and browner, the general tone of upper parts inclining, more or less strongly, to tawny brown, with lighter markings brownish buff or pale cinnamon, the under parts more or less strongly suffused with pale cinnamon, the legs (especially thighs) light tawny; gray phase (which is relatively rare) similar to *O. a. bendirei* and *O. a. macfarlanei* but very much darker (the general color of upper parts approaching fuscous) and with lighter markings light brownish buffy instead of white, and the under parts much more heavily penciled and spotted."

J. Hooper Bowles (1917a) says of the haunts of this owl: "The most favored localities are in the immediate vicinity of water, either fresh or salt, where the country is to some extent open. Deciduous timber seems to be given a slight preference over the fir woods, as a rule, though during the day the birds are usually found hiding amongst the dark foliage of some young fir."

Nesting.—He says that the nests are very rarely found, and that "the eggs are almost invariably deposited in natural hollows in trees, the only exceptions being extra big holes made by the Northwestern Flicker (*Colaptes cafer saturatior*). One of these two cases was a hole that had been excavated to a depth of only about six inches, in a lone dead fir stub that stood in a vacant lot in the city. A most unusual nesting site in every way for these owls, as the cavities used are most often two or three feet in depth and situated in well wooded localities. The nests that I have seen were placed from four to twelve feet above the ground, but it is impossible to say what the average height may be in this country where trees two hundred feet tall are the rule rather than the exception."

F. R. Decker (1912) mentions a nest that he found about 60 feet from the ground in a cavity in a cottonwood tree; doubtless these lofty cavities are seldom investigated by collectors.

Eggs.—Kennicott's screech owl lays two to five eggs. Mr. Bowles (1917a) says: "I think that complete sets will usually be found to contain three eggs, although two are nearly as often the full number. In only one instance have I seen as many as four. In color they are pure white and somewhat glossy, with more or less nest stain according to the state of incubation. They are usually nearly spherical in shape, like the eggs of most owls, but occasionally there is a slightly elliptical tendency."

He evidently changed his mind, as to the number of eggs laid, for, in an earlier article (1906a) he says that the eggs "are from two to four in number, four being most commonly found." Mr. Decker (1912) mentions two sets of four and one of five.

The measurements of 33 eggs average 37.8 by 32 millimeters; the eggs showing the four extremes measure **42** by **35.6**, **33.3** by 31, and 35.3 by **30** millimeters.

Plumages.—Kennicott's screech owl has two well-marked color phases, a gray one and a brown one, which are described above. The color phases in this race are more pronounced than in the other Pacific coast races, and more generally recognized, though nearly all the races, if not all of them, show some tendency to dichromatism.

Food.—Mr. Bowles (1917a) has published some interesting items on the food of this owl; he says that a—

> bird was taken on January 6, 1917, at which time the thermometer was somewhat above freezing with no snow on the ground. The stomach contained eleven cutworms, two centipedes, one mole cricket, one good sized beetle, and other insect remains. With all this on the credit side of their ledger, these owls are at times subject to some most astounding falls from grace. The fact does not reflect

> very greatly to their credit that nests containing incubated eggs or young are usually well sprinkled with the feathers of smaller birds. However, this might be more or less natural if rodents and other small animals were scarce, but the following incidents seem beyond all comprehension. One friend told me that he heard an outcry among the ducks in his yard one night and, upon going out with a lantern, "found a Screech Owl riding around on the back of one of his big ducks, hanging onto its neck."

Then he goes on to tell of the experience of his friend, Dr. G. D. Shaver; a pair of these owls—

> came and nested on his place within a short distance of his pens of gamebirds and fancy bantams, and, as the entrance of the nest was only four feet from the ground, the doctor took great pleasure in watching the sitting bird and her family as they grew up. One morning during the winter of 1914–1915, which was a very mild season, he was nearly overcome upon visiting his yards to find two dead Golden Pheasants, four dead Ring-necked Pheasants, and one Ring-neck cock so badly hurt that it died a few days later. All were, of course, grown birds at that time of the year. The injuries were nearly all gashes and rips in the head and neck, so the blame was laid to rats although none were ever seen or caught there. * * * On the morning of February 4, 1916, the doctor visited his yards and found a scene of murder similar to that of the previous year. In one pen were four of his prize Buff Cochin Bantams mangled and dead, some being in their house and others out in their yard, while in another pen were two fine cock Golden Pheasants in a similar condition. The wounds were similar in location and character to those made on the birds killed about a year before, but this time part of the head of one of the bantams had been eaten. There was no indication whatever of what had caused the damage, nor of how any predatory creature could have entered, so the doctor put a liberal dose of strychnine into the body of the partly eaten bantam and replaced it in the same spot where he found it. Next morning the seemingly impossible was made a practical certainty, for he found the body of a screech owl with the claws of one foot firmly imbedded in the body of the bantam.

Elsewhere, Mr. Bowles (1906a) says: "On one occasion at an evening lawn party in the city, one of these owls spent more than half an hour catching what I am positive were angle-worms. He would swoop down onto the lawn and stay for perhaps a minute, returning each time either to one of a small group of maples or to the roof of the house. It was too dark to distinguish what he was catching, but he paid no more attention to the people walking near him than an occasional turn of the head, busying himself with poking about in the short grass with his bill."

S. F. Rathbun writes to me: "In my collection is a fine specimen of this owl, which I collected after dusk one night in spring. At the time the owl was lurking about the eaves of a barn on a farm. I had an idea that the owl was after some cliff swallows that were nesting under the eaves of the outbuilding. But I did the bird an injustice, I think, for when I skinned it I found its stomach and gullet packed with ants, the large, black pismires sometimes found so common about farm buildings. The owl was so full of the insects that a few of them hung from the corners of its mouth, and its stomach was hard to the touch, so tightly was it packed with ants. I have always regretted that I shot the bird."

Mr. Bowles (1906a) writes:

> During the greater part of the year these owls are entirely beneficial, their food consisting mostly of mice. Large beetles are often added, and nearly every small stream shows signs of where an owl has successfully angled for craw-fish, carefully splitting and picking the meat from the shell. After the eggs are hatched, however, the parents are at their wit's end to procure food enough for the hungry babies, and it is at this season only that birds are used in the bill of fare. The northwestern flicker seems to be found especially delectable, tho feathers of the Steller jay, western robin and a few other species are sometimes found in the hole with the young. Curiously enough it is most unusual to find remains of juncos, sparrows or other small-sized birds; and, all things considered, these owls unquestionably do many times as much good as they do harm.

Voice.—In the same paper Mr. Bowles says on this subject: "The high-keyed, tremulous hooting cry of these birds is, strangely enough, most often heard during the fall months. In spring and summer, tho repeatedly spending the night in localities where they were tolerably abundant, I have never heard them utter a note of any description."

OTUS ASIO MAXWELLIAE (Ridgway)

ROCKY MOUNTAIN SCREECH OWL

Plate 66

HABITS

This large, pale race is the whitest and, to my mind, the handsomest of our screech owls. Ridgway (1914) describes it as—

> decidedly larger and very much paler than *O. a. aikeni;* nearly as large as *O. a. macfarlanei* and *O. a. kennicottii,* but conspicuously lighter than any other form, with the white purer and more extended and the colored parts paler; ground color above pale gray or grayish brown, relieved by the usual ragged mesial streaks of black and irregular mottlings and vermiculations of lighter and darker shades of grayish, the general color more rufescent, and no darker than very light ash gray or drab; white spots on outer webs of primaries frequently confluent along edge of quills, the darker spots sometimes hardly visible on proximal portion when wings are closed; under parts with pure white greatly predominating.

Its range is given in the 1931 Check-List as "foothills and plains adjacent to the eastern Rocky Mountains from eastern Montana and western South Dakota to central Colorado." I suspect that it may range even farther north along the eastern edge of the mountains. It is said to be resident all through the year throughout its range.

Robert B. Rockwell (1907) writes:

> Both Denis Gale and W. W. Cooke state that *M. a. maxwellæ* rarely ascends higher than 6000 feet, which would preclude the possibility of its extending more than a few miles up into the foothills, and the most easterly record is recorded by Cooke as "30 miles out on the plains", probably referring to the Loveland, Colo-

> rado, record of W. G. Smith. * * * From this it will be seen that *maxwellæ* is strictly a foothills form, inhabiting a long, narrow strip of country running in a general north and south direction and closely adhering to the base of the eastern foothills of the Rocky Mountains. * * *
>
> The Rocky Mountain Screech Owl * * * is a resident thruout the year all along the eastern base of the foothills in the north central part of Colorado, but its hunting and breeding grounds are closely restricted to the well wooded creek bottoms, the only locations in this sparsely timbered region which afford him proper food, nesting sites and means of concealment.
>
> As to whether this bird performs a slight north and south movement at migration periods, there seems to be a difference of opinion. Some observers declare that Megascops leaves its summer home around Denver, and moves south as far at least as Colorado Springs (75 miles), and its breeding grounds are occupied as a winter home by migrants from farther north. Others claim that it spends the entire year in the same haunts, laying its eggs in one of the many cavities occupied during the winter. Whichever view of the matter is correct, it is a fact that thruout the year the "owl stumps" so dear to the memory of every bird student, are occupied by these birds, and it is seldom indeed that a good sized grove of aged timber, with a few dead stumps scattered thru it, will not contain a pair of Screech Owls.

Nesting.—The same observer says on this subject:

> As has been stated before the nesting site is invariably along the well wooded water-courses and in more or less dense groves of cottonwoods and occasionally willow or box-elder. A peculiar characteristic of this bird is its predeliction for sluggish or stagnant water, and one of the prerequisites of a model nesting site is a small slough or pool within a short distance of the nest hole. I am at a loss to know why this is so, unless it is that frogs and crawfish form no inconsiderable portion of the bird's food, and close proximity to a source of food supply may be a solution of the problem.
>
> The very great majority of nests are found in cottonwood trees. This is probably due to the fact that this tree greatly predominates along all the foothill streams, and it is the variety most commonly used by the Red-shafted Flicker, the deserted excavations of which the Screech Owl nearly always occupies. However, natural cavities are occasionally resorted to; but owing to the nature of the trees these are found mostly in box-elder or black willows, the cottonwood rarely rotting out in this manner.

Major Bendire (1892) says that the first nest of this subspecies was discovered by A. W. Anthony on May 4, 1883, in the trunk of a large cottonwood; the nest contained three young about a week old and an addled egg; it was in a knothole within 4 feet of a new nest being excavated by a red-shafted flicker, but on the opposite side of the trunk. He says, also, that Mr. Anthony thinks that this screech owl breeds also in the abandoned nests of the black-billed magpie, as he has often found them roosting in them both in winter and spring. Both Denis Gale and William G. Smith told him that they had found them nesting in such places.

Eggs.—Mr. Rockwell (1907) says:

> The great majority of full clutches contain four eggs, tho occasionally three or five are deposited. In the twenty-five sets it has been my good fortune to examine in the nests, the following sets were found: One of 2, five of 3, fifteen of 4, two

of 5, one of 6 and one of 7. The set of 2 was a second clutch, the first set of 4 having been taken 23 days previously to the date upon which the set of 2 was found in which incubation was about a fourth advanced. The comparatively large number of sets of three conveys a wrong impression, and is probably due to a little over-anxiety to collect the eggs, not giving the parent sufficient time to complete the clutch. I believe one in fifteen sets would be nearer the proper ratio of sets of 3 and 4. The set of 6 was laid by a particularly prolific female which had laid sets of five on the two preceding years; while the set of seven I cannot account for unless it was laid by two females, which is very improbable. This was found May 30th, two birds were flushed from the cavity, and all seven eggs were addled.

Major Bendire (1892) says: "The eggs of the Rocky Mountain Screech Owl are pure white in color and moderately glossy; the shell is smooth and finely granulated. In shape they vary from oval to a broad elliptical oval, some being decidedly more elongated than any other eggs of the genus *Megascops* I have seen."

The measurements of 54 eggs average 36.3 by 30.2 millimeters; the eggs showing the four extremes measure **39.1** by 32.1, 36.1 by **32**, **30.9** by 30.7, and 35.7 by **27.9** millimeters.

Young.—Bendire (1892) says: "In the latter part of June, before they are well able to fly, they may be seen sitting side by side, perfectly motionless, upon a limb close by the nest site. The young and their parents seem to desert their holes and live among the trees for the balance of the summer; but when the cold winds strip the leaves from the trees in the fall suitable tree holes are selected for their winter quarters."

Plumages.—This race is supposed to be monochromatic, but Dr. Louis B. Bishop writes to me that he has a specimen of this race in the red phase, collected in Saskatchewan, which he and Dr. H. C. Oberholser both agreed to identify as *maxwelliae*, though it is apparently the only red specimen known. He says that the red phase agrees with the gray phase in being very pale, with the facial disks, tarsi, and toes white, and that the red is paler and slightly browner than in the red phase of *naevius* from Connecticut.

Food.—Major Bendire (1892) says that Mr. Anthony found "a good many fish scales" in a nest of one of these owls, and that Denis Gale found feathers of the mountain bluebird and several sparrows in a nest. He quotes him as saying that the female, while incubating, "is waited upon and fed by the male, who, being a skillful hunter, provides liberally for her wants. Searching for nests I have sometimes discovered the male hidden in a tolerably well stocked larder, in close proximity to the nest site. In one cache were portions of a Bluebird, a mouse, and a frog; in another a Junco, a Tree Sparrow, and a minnow 3½ inches long; claws and legs of crawfish were also present."

Behavior.—He quotes Mr. Dale further as follows:

Like others of their genus they seem to delight in a sheltered, shady location, close to a pond or creek where they select a domicile, either in a natural tree hole

> or in a Flicker's old nest site. If for any reason the Flicker wishes to retain his previous year's nest site, and Scops is in possession, strife is carried on between them with great vigor, ending as often in favor of one as the other, judging from the broken eggs upon the ground ejected by the victor. The Flicker dares not enter to turn Scops out, but if the premises are vacated for ever so short a time, he enters and holds them against all comers. His formidable bill pointing out at the door is sufficient apology for leaving him in quiet possession.

Again, when the female is taken off her eggs: "In some instances she will feign dead and lie on her back in your open palm with her eyes shut. Immediately you throw her off, however, she will right herself on wing, and gaining a bough on a neighboring tree will crouch forward, bending her eartufts back and look very spiteful and wicked. At other times when removed from her eggs she will snap her bill, moan slightly, and show fight."

Mr. Rockwell (1909) says that this screech owl makes frequent use of the abandoned nests of the black-billed magpie "when not occupying a cavity in a tree. It is a rather amusing spectacle to see a round, fluffy little screech owl (dislodged from his cosy corner in a hollow tree) making desperate efforts to reach the nearest magpie nest before the noisy throng of mischief-loving magpies overtakes him, and even more comical to see the plain look of disappointment and incredulity upon the 'countenances' of the pursuers, as the owl reaches the welcome refuge and instantly merges himself into its surroundings; for strange as it may seem magpies will not follow an owl into an abandoned nest, and seem utterly at a loss to understand the prompt disappearance of the object of their pursuit."

Winter.—That the Rocky Mountain screech owl remains all winter throughout its more northern breeding grounds is indicated by the following account by Major Bendire (1892):

> While stationed at Fort Custer, Montana, during the winter of 1884–'85, I took five of these birds, but was unable to find their nests. I discovered their presence quite accidentally. On December 1, 1884, while out hunting Sharp-tailed Grouse in a bend of the Big Horn River, a few miles south of the post, as I was walking by a thick clump of willows I indistinctly noticed a whitish looking object dropping on the ground, apparently out of the densest portion of the thicket and on the opposite side from where I was standing at the time, and simultaneously heard several plaintive squeaks from that direction. Carefully skirting around the thicket, which was some 20 yards long and perhaps 5 yards wide, I saw the object of my search savagely engaged in killing a meadow mouse which it had just captured. I promptly shot it. It proved to be a female and excessively fat; in fact all the specimens I secured subsequently showed conclusively that they managed to secure an abundance of food in that Arctic winter climate, and that a portion of this at least seems to be obtained in the daytime. The four other specimens collected by me were all obtained in similar locations.

Dr. Joseph Grinnell (1928a) has described a new race of the screech owl from eastern California, which he calls *Otus asio inyoensis*. He says that it is "characterized in comparison with other southwestern races by large size and extremely pale coloration; ground-color of dorsum near drab-gray; streaking of both upper and lower surfaces narrow, sharply outlined, and black; white about head, on lower surface of body, and on feathering of legs, clear and extensive." He says that it most closely resembles *maxwelliae*, but differing from it "in still paler, more ashy and less brownish tone of general coloration; dark vermiculation beneath and on legs more sootily black; the white spots on the outer webs of primaries in closed wing much the smaller in *inyoensis*, and the intervening correspondingly broader dark bars decidedly grayer in color."

OTUS ASIO CINERACEUS (Ridgway)

MEXICAN SCREECH OWL

HABITS

The Mexican screech owl occupies the Upper Austral Zone in central Arizona, southern New Mexico, central western Texas, and parts of Lower California and Sonora. Further remarks on the local distribution of this race, in relation to the closely related *gilmani*, will be found under that race.

Ridgway (1914), under the common name Arizona screech owl, describes this race as "similar to *O. a. aikeni*, but more delicately penciled, both above and below, the pencilings on under parts averaging denser or more numerous."

Nesting.—Major Bendire (1892) says:

> In the oak regions of southern Arizona they nest in the natural cavities of these trees, most of which are hollow. On March 26, 1872, I found one of their nests in an old woodpecker's hole in a willow stump not more than 7 inches in diameter and about 6 feet from the ground. The cavity was slightly over 2 feet deep, and the four eggs it contained, which had been incubated for a few days, were lying on bits of rotten wood and a few dead leaves, not sufficient to call a nest. The female was at home and had to be taken out forcibly, protesting and uttering a hissing sound, and, after being turned loose, snapping her mandibles rapidly together from her perch on a small walnut tree, into which she had flown. I was in hopes she might continue to use the same site again, but was disappointed in this.

On April 16, 1922, in a row of immense cottonwoods along an irrigation ditch, near Fairbank, Ariz., we found one of these owls asleep in a lofty hole in one of these trees. Again, on May 17, in the same region, we found another in a cavity in a low willow. But there were no eggs in either hole.

Eggs.—Major Bendire (1892) says: "The number of eggs laid is usually three or four, rarely five. They are similar in shape and color to those of the rest of this genus. Now and then a set is found which is so badly stained by the extrement of fleas inhabiting their burrows in large numbers that the eggs, judging by their color, might be taken for those of the Sparrow Hawk."

The measurements of 37 eggs average 34.3 by 28.8 millimeters; the eggs showing the four extremes measure **35.5** by 29, 34.9 by **29.9**, 32 by 28.8, and 34.1 by **24.1** millimeters.

Plumages.—This screech owl seems to be wholly monochromatic, as nothing approaching a gray or a brown phase has yet been discovered, the universal color being pale, ashy gray.

Food.—Mrs. Florence M. Bailey (1928) lists, as the food of the Mexican screech owl, "kangaroo rats, gophers, mice, rats, small birds, frogs, lizards, snakes, crawfish, scorpions, grasshoppers, locusts, and beetles. It is one of the most insectivorous of our owls."

Behavior.—Henry W. Henshaw (1875) writes:

> This bird was very common both in Arizona and New Mexico, and is, I think, the most numerous of the family in this region. Whenever our camp chanced to be made near one of the groves of oaks, which are numerous, these owls were sure to be heard soon after dusk, and, not infrequently, several would take up their stations in a tree within a few feet of the camp fire, and remain for an hour or more, apparently to satisfy their curiosity, uttering, from time to time, their low, responsive cries. Their notes vary much in length, but, when full, consist of two prolonged syllables, with quite an interval between, followed by a rapid utterance of six or seven notes, which, at the end, are run together. They are very sociable in their disposition, and, as soon as it is fairly dusk, the first call of a solitary bird may be heard issuing from some thicket, where it has remained in concealment during the day. After one or two repetitions, this will be answered by another, perhaps half a mile away, and soon by a third and a fourth, apparently all coming together; and I have heard at least eight of these owls, congregated within a short distance in the tree tops. When the band was complete, they would move off, still apparently keeping together, till their notes were lost in the distance.

Enemies.—Mrs. C. J. Whitfield (1934), of Globe, Ariz., tells the following interesting story:

> A heavy flapping of wings attracted our attention to an Arizona oak tree (*Quercus arizonica*) about five yards from the house. Approximately 12 feet from the ground, and quite close to the trunk, a snake over three feet long (probably *Pituophis catenifer rutilus*) hung suspended by its tail from a small dead limb. The large part of the snake's body was coiled once around a small owl, judged from its color and size to be a screech owl (*Otus asio cineraceus*). The bird struggled more and more feebly for three or four minutes, and finally was still.
>
> When we shot the snake, its body grew slack, and its tail loosened its hold on the limb and began to slip. The owl freed itself and flew away, seemingly uninjured. The owl had apparently been roosting in the tree, and was "stalked" and caught by the snake.

OTUS ASIO AIKENI (Brewster)

AIKEN'S SCREECH OWL

HABITS

The A. O. U. Check-List (1931) gives the range of this subspecies as "foothills and plains of eastern Colorado and Kansas north to northeastern North Dakota and northwestern Minnesota and south to New Mexico." Ridgway (1914) extends its range farther southward into western and central Texas, and into northern Durango.

William Brewster (1891) describes it as "of about the size of *M*[*egascops*] *bendirei*, with the ground color more ashy; the dark markings coarser, and more numerous and conspicuous, than in any other North American member of the genus." Ridgway (1914) describes it, from another angle, as "similar to *O. a. cineraceus* but larger, the upper parts more coarsely mottled or vermiculated and with blackish mesial streaks broader and more strongly contrasted with the general color; blackish pencilings of under parts heavier, rather less numerous. Smaller and much darker than *O. a. maxwelliae.*"

Mr. Brewster (1891) says: "I had the skin of Mr. Aiken, who, if I remember aright, asserted that it was a fair representative of the form which inhabits cottonwood timber along streams in the plains region about Colorado Springs, *maxwelliae*, of which he showed me several typical specimens, being confined to the neighboring mountains."

Nesting.—Charles E. H. Aiken (Aiken and Warren, 1914) says that he "has never found it anywhere except in cottonwood trees along the streams. * * * A pair bred in 1913 in a flicker's hole in a tree on St. Vrain Street, Colorado Springs beside the home of Dr. W. W. Arnold, raising four young. The owls drove away the flickers which had bred in the hole the year before, taking possession for themselves."

Major Bendire (1892) writes: "Dr. R. W. Shufeldt, U. S. Army, found a Screech Owl breeding near Fort Wingate, New Mexico, which I think is referable to this subspecies. He took three well incubated eggs on April 18, 1887, from a cavity in an oak tree 10 feet from the ground, capturing alive both parents at the same time. I have seen photographs of these specimens, and they show every indication that the originals belonged to this race."

There are two sets of eggs of this owl in the Thayer collection. One was taken at Rowse Junction, Colo., on May 9, 1899; the two fresh eggs lay on a lot of trash and rubbish in a cavity 8 inches deep in a live cedar. The other set of four eggs was taken in Decatur County, Kans., on April 13, 1913; the nest was in an abandoned flicker hole, 14 inches deep, in a poplar tree 18 feet from the ground; the eggs were deposited on decayed chips and a few feathers.

Eggs.—Three or four eggs are usually laid by this owl; these are indistinguishable from the eggs of other screech owls of similar size. The measurements of 28 eggs average 36 by 30.7 millimeters; the eggs showing the four extremes measure **38.2** by 30.5, 37 by **35.9**, **34** by 30, 36.5 by **29.4** millimeters.

Plumages.—Aiken and Warren (1914) write: "January 9, 1904, a Screech Owl in the red phase was taken near Colorado Springs, the skin of which is now in the Aiken Collection. This skin was examined by Mr. William Brewster, who pronounced it to be typical *Otus asio asio*. Later Mr. H. C. Oberholser also examined it, and considers it to be the red phase of *aikeni*, and tells us that he has seen several other specimens of the red phase of this subspecies, and that while very close to the red phase of typical *asio* they may be distinguished by being slightly paler in color." Dr. Louis B. Bishop writes to me that he also has the red phase of this race in his collection.

Voice.—Mr. Aiken (Aiken and Warren, 1914) gives the following account of the notes uttered by a young female that he had in captivity:

> Its baby or birdling call was like the smothered mew of a kitten; this was frequently uttered as a call for food or in answer to its name, or as a call to me for notice. After completing its moult this cry was not often uttered unless she was hungry and demanding attention. A note that was uttered when excited was a short *wow, wow*, repeated several times, reminding me of a puppy's bark. This was uttered at times when very hungry and demanding immediate notice, and was also uttered as notice of the presence of a dog—very vehemently when a dog came into the shop. A note like *cr-r-oo-oo-oo-oo-oo-oo* uttered gently and so low as to be heard only a few yards away was seemingly a love note and was an affectionate greeting to me as it would be to her mate. Then another note similar, possibly the same under other conditions was like the whistling of ducks' wings in overhead flight at night.

OTUS ASIO MACFARLANEI (Brewster)

MacFARLANE'S SCREECH OWL

HABITS

This large race of the screech owl occupies an interior range in southern British Columbia, eastern Washington and Oregon, western Montana and Idaho, and northeastern California. Major Bendire (1892) says of its haunts: "MacFarlane's Screech Owl is a constant resident wherever found and its habitat as far as known seems to be restricted to the timbered bottom lands of the lower sagebrush and bunch grass covered valleys and plains of the dry interior portions of the States above mentioned. It seems to avoid the mountains, and I do not believe that it is found at much greater altitudes than 4,000 feet."

William Brewster (1891), in naming and describing this subspecies, characterized it as "of the size of *M. kennicotti*, but with the color and markings of *M. bendirei*." This race has a gray phase and a brown phase, but in the latter phase it is not as dark as *kennicotti*.

Nesting.—Major Bendire (1892) writes: "Its general habits are in no way different from those of the other members of the genus *Megascops*, excepting that on account of its larger size it is compelled to nest entirely in natural cavities of trees, the excavations made by the larger Woodpeckers breeding in the same localities, like *Melanerpes torquatus* and *Colaptes cafer*, being too small to accommodate them."

He says of his first nest, found in southeastern Oregon on April 16, 1877.

> This nest was found in a hollow willow stump, in a small grove of these and cottonwood trees among which I camped while on a hunt after waterfowl on Lower Silvies River, near Malheur Lake, 20 miles southwest of Camp Harney, Oregon. The hole was about 5 feet from the ground, 18 inches deep, and contained six partly incubated eggs. There was no nest, the eggs lying on some rubbish which had accumulated in the hole; the female was caught on the nest, and beyond snapping her mandibles made no resistance; the male was not seen. * * * In 1881 a pair of MacFarlane's Screech Owls nested in a natural cavity of a good sized cottonwood tree, about 25 feet from the ground, and within 100 yards of my quarters, giving me ample opportunity to watch them. Whenever I rapped on the tree the occupant would stick its head out and look about, but did not fly away.
>
> All the nests found near Walla Walla, Washington, were placed in natural cavities in cottonwood trees, from 15 to 30 feet from the ground, and invariably near water.

Eggs.—Bendire says that the eggs "vary from three to six in number, usually four or five, and are deposited at intervals of one or two days. * * * The eggs like those of all owls are pure white in color, rather glossy, and mostly oval in shape; some are nearly spherical; the shell is smooth and closely granulated."

The measurements of 39 eggs averaged 37.6 by 31.9 millimeters; the eggs showing the four extremes measure **39.3** by 32.2, 39 by **33.5**, **35** by 31.5, and 37 by **30** millimeters.

Food.—The feeding habits of MacFarlane's screech owl are apparently similar to those of other screech owls; it has been known to kill domestic pigeons.

Bendire (1892) writes: "In two of the holes occupied by them I found trout from 6 to 8 inches long and a small whitefish (*Coregonus williamsonii*) about 10 inches long. It still puzzles me to know just how they manage to catch such active fish, but believe that, where obtainable, these as well as frogs form no inconsiderable portion of their daily fare, while the smaller rodents and grasshoppers supply the remainder. I do not believe it catches birds to any extent, and must be considered an eminently useful species."

OTUS ASIO HASBROUCKI Ridgway

HASBROUCK'S SCREECH OWL

HABITS

The screech owls of central Texas have been separated from *mccalli* under the above name. The 1931 Check-List says: "Central Texas, from Travis County to Palo Pinto and Dallas counties, and probably other adjoining counties." Ridgway (1914) adds, with some doubt, Cooke, McLennan, Eastland, and Lampasas Counties, as probably within its range. He describes this race as "similar in pattern of coloration to *O. a. mccallii* but decidedly larger, darker, and much less buffy gray above, and under parts much more heavily penciled, the transverse bars, especially, being much broader, as well as more numerous; mottling of legs much darker brown; rufescent phase similar to that of *O. a. naevius*."

E. M. Hasbrouck (1889), for whom this owl was named, describes part of its supposed habitat as follows:

> Eastland County, Texas, is situated between latitudes 32°–33° and longitudes 98°–99° or a little northeast of the geographical centre, and is known throughout the country as the poorest and most unattractive portion of the State. The elevation varies from twelve hundred to sixteen hundred feet, and the entire County, as well as a number of those lying to the east, is one series of terraces, beginning a little west of Cisco and extending through Erath and Bosque Counties, until the valley of the Brazos is reached. Water is extremely scarce and the timber, although pretty generally distributed, is almost entirely of oak, and comprises four species, known as post-oak, bur-oak, black jack, and "shinnery." This last is a short, stunted bush, frequently covering hundreds of acres and rarely exceeding four or five feet in height.

Nesting.—George Finlay Simmons (1925) says of its nesting habits in the Austin region: "Nest location, 6 to 25, usually 16, feet up in natural hollow in cedar elm, live oak, post oak, or sycamore tree or stump, generally standing on creek bank; once in old woodpecker hollow in telephone pole in town. Hollow, sometimes bare, generally scantily carpeted with small decayed wood chips, a few feathers, or debris of dead leaves, twigs, straw, grass, Spanish moss, or crawfish crusts."

Mr. Simmons (1915) describes a nest in another locality, probably of this subspecies, as follows: "April 5, 1913, in the woods on Buffalo Bayou about four and a half miles west of Houston, I found a nest in a natural hollow of an elm tree standing on the slope of the bayou; it contained four eggs, incubation far advanced. The entrance to the cavity was nine feet from the ground at a bend in the trunk of the tree; from the bend the cavity extended almost vertically down into the heart of the tree, about thirty inches deep and six inches in diameter; trunk of tree about ten inches in diameter. Only a few leaves and grasses, with a slight lining of feathers, were between the eggs and the bottom of the cavity."

Howard Lacey (1911) writes:

> A pair of these birds tried to breed in a small heating stove in the house in 1896 and again in 1897, coming down the stovepipe which had a double elbow and laying in the stove: they made too much noise scratching up and down the stovepipe and so had to be discouraged. They often lay their eggs in houses put up for the martins or for pigeons and I think destroy the young birds. In May, 1908, a pair nested in the martin box at the ranch. Finding a dead martin under the box, I got a shotgun and sent a friend up the pole to investigate: an owl flew out and was promptly shot and then my friend found three young owls in the box, and brought them down, and put them under a live-oak tree in the yard. The

remaining parent fed the young for a night or two on the ground, bringing them, among other things, two or three sphinx moths and a crawfish, and then persuaded them to climb into the tree. The next evening my friend was smoking after supper and the owl knocked his pipe out of his mouth. The owl next attacked the lady of the house as she was bringing in the milk, and as a final exploit struck me full in the face as I was standing near the tree, using force enough to draw blood. The next morning the whole owl family was put to death.

Eggs.—According to Mr. Simmons (1925), this owl lays three or four eggs, "sometimes 5, rarely 6, globular oval, pure white, with moderately smooth, finely granulated shell." The measurements of 27 eggs averaged 34.8 by 30 millimeters; the eggs showing the four extremes measure **37.1** by **31, 32.5** by 30, and 35.7 by **28** millimeters.

Plumages.—Dr. Louis B. Bishop tells me that in the red phase this owl is "bright red above, a paler and browner red than *asio*, with broad, black shaft streaks; the red is browner than red *maxwelliae*."

Behavior.—Mr. Hasbrouck (1889) says of this screech owl: "Common everywhere, and as bold and daring as others of the genus. I remember one occasion when I had a fine string of Teal hanging in camp. I was awakened by the hooting of one of these birds on a limb directly over my head and but a few feet above me; securing him and returning to rest, I had no sooner rolled up in my blankets than his perch was taken by another which, it is needless to say, followed the fate of the first."

Voice.—Mr. Simmons (1925) calls the voice a "weird, blood-curdling, quavering tremulo" and says: "There are two short notes, often uttered alone, occasionally used to begin the tremulous screech, a very low, short hoot, *proot*, and a puttering, beating *put t t t*, again, a low *goop-goop*."

OTUS ASIO BREWSTERI Ridgway

BREWSTER'S SCREECH OWL

HABITS

The range of this race is given in the 1931 Check-List as "Oregon, west of the Cascades, and Chelan County, Washington, south to Humboldt County, California." Ridgway (1914) mentions only "western Oregon." Dr. Louis B. Bishop has 11 specimens, ten from Oregon and one from Humboldt County, Calif., which he refers to this race.

Ridgway (1914) describes it as "similar to *O. a. kennicottii*, but smaller, and coloration much less brownish, the lighter markings on the upper parts less pronouncedly buffy, the under parts much less (sometimes not at all) suffused with buff. (Intermediate between *O. a. kennicottii* and *O. a. bendirei*.)" It has a gray phase and a brown phase, intermediate between the phases of the two forms named above. This is admittedly an intermediate form which, in the author's opinion, should never have been named.

Its habits are doubtless similar to those of the neighboring races. The measurements of 10 eggs average 37.3 by 31.2 millimeters; the eggs showing the four extremes measure **39** by 31.3, 38 by **32.5, 35.6** by 31.3, and 37.2 by **29.7** millimeters.

OTUS ASIO QUERCINUS Grinnell

PASADENA SCREECH OWL

Plate 67

HABITS

According to the 1931 Check-List this race occurs in "southern California west of the desert region and along the western flank of the Sierra Nevada north to Mt. Shasta; also on the Pacific side of northern Lower California north of lat. 30°30′."

Dr. Joseph Grinnell (1915), in describing and naming it, says: "Characters in general like *Otus asio bendirei;* differs in paler coloration: Light drab or ashy rather than hazel tones prevail dorsally, while beneath the black markings are sharper in outline, with very little or none of the ferruginous marginings. The restriction or absence of ferruginous on the chest, around the facial rim, and on the ear-tufts, is a good character."

Nesting.—There is apparently nothing in the nesting habits of this race that calls for special comment, as they are similar to those of other races. But an unusual nesting site is thus described by John McB. Robertson (1925): "April 29, 1923, I discovered a nest in a bark-filled crotch of a large eucalyptus tree beside our driveway, and only about twelve feet from the ground. The nest was well concealed by several years' accumulation of bark and trash and when discovered contained one adult bird and three partly feathered young."

Eggs.—The Pasadena screech owl lays ordinarily four or five eggs, sometimes only three, and perhaps rarely six. These are indistinguishable from other screech owls' eggs of similar size. The measurements of 46 eggs averages 35.4 by 30.2 millimeters; the eggs showing the four extremes measure **38.2** by 30.2, 35.8 by **31.8, 32.4** by 30.3, and 34 by **27.1** millimeters.

Young.—E. Lowell Sumner, Jr. (1928 and 1929) has made some extensive studies of the development of young Pasadena screech owls and has published two papers on the subject, to which the reader is referred. The progress of their growth is not materially different from that of the eastern screech owl, which has been quite fully explained under that race. He says, however: "In closing, two features seem to deserve special mention. One is the fact that after the eggs had first begun to pip, more than three days elapsed before the time of hatching. The other is the unaccountable fluctuation in the weights of the youngsters, as illustrated by the graph."

Plumages.—The sequence of plumages to maturity is the same as given for the eastern screech owl. As in practically all the western races, adults are to some extent dichromatic, though the color phases are not so pronounced as in the eastern races. The gray phase of *quercinus* is lighter gray, and the brown phase is duller brown than in the more northern races.

OTUS ASIO GILMANI Swarth

SAGUARO SCREECH OWL

HABITS

Ridgway (1914) does not recognize the validity of this race, and says, in a footnote under *cineraceus:* "With a considerable series of specimens before me, including those upon which *O. a. gilmani* Swarth was based, I am quite unable to appreciate reasons for the recognition of that supposed subspecies; indeed, few of the recognized subspecies of the group present as great uniformity of coloration as does this series as a whole." He also thought that the difference in size is insignificant, and he could not accept the theory of two subspecies occupying such closely contiguous territory.

Mr. Swarth (1916), however, seems to have explained the situation very satisfactorily, and to have established the validity of his race, after an extensive study of a series of thirty screech owls from various parts of southern Arizona. He concludes that—

> there *are* two distinct types represented, *cineraceus* from the higher mountains, *gilmani* from the valleys of southwestern Arizona. Breeding birds from either region are true to type in their appearance. Extremes of the *gilmani* characteristics appear at points farthest from the known range of *cineraceus* (as at Phoenix and on the Colorado River). At one point at the margin of the habitat of *gilmani* (as I conceive it) there occur in winter examples of *cineraceus.*
>
> There are certain facts in the distribution of screech owls in Arizona which deserve to be emphasized. My conception of *Otus a. gilmani* is of a bird of the hot Lower Sonoran valleys, and of *Otus a. cineraceus*, as one pertaining to Upper Sonoran, oak-covered foothills and canyons. But I believe that a sufficient representation of specimens would show the respective ranges of the two subspecies to be capable of definition on other terms than those of life zones. In southeastern Arizona, the region of the scattered mountain ranges where *cineraceus* occurs, the intervening valleys and plains, of vast extent, are for the most part grass covered, or else with but a sparse growth of mesquite or larrea, in neither case supplying habitable surroundings for the screech owl. Farther west, from the Santa Rita and Santa Catalina mountains westward, the endless stretches of Lower Sonoran plains where *gilmani* is found are grown up nearly everywhere with the giant cactus, which supplies so many hole-dwelling birds with homes. In other words, in southwestern Arizona the Lower Sonoran zone offers congenial surroundings to screech owls, in southeastern Arizona for the most part it does not. In southwestern Arizona, Lower Sonoran is the only life zone represented, in southeastern Arizona the higher zones occur, with associational conditions acceptable to these owls.

In naming and describing this race, Mr. Swarth (1910b) gives as its characters: "Most like *Otus asio cineraceus* (Ridgway), from which it differs chiefly in slightly smaller size, paler coloration and greater restriction of dark markings. Above pale ashy, darkest on crown, each feather faintly vermiculated with dusky, and with a narrow dark median stripe. Under parts somewhat darker, but still with dark markings much restricted. Legs and toes white, sparsely marked with dusky."

Nesting.—We spent May 21 and 22, 1922, exploring the dry, hot saguaro plains near Tucson, Ariz. Here the arid, stony ground was scantily covered with low mesquite and greasewood bushes, among which the picturesque candelabra of the giant cactus, with their crowns of white blossoms, were widely scattered. My husky companion, Frank C. Willard, carried upright on his strong shoulders an 18-foot ladder, with which we investigated the numerous cavities in these strange plants. There were very few saguaros that did not contain some of these nesting holes, and many had three or four. The holes were, doubtless, all originally made by Gila woodpeckers and Mearns's gilded flickers, which were very numerous here. These holes last for many years, as the interior walls become crusted over and hardened, making ideal nesting sites, after the woodpeckers have abandoned them, for elf and screech owls, Arizona crested and ash-throated fly-flycatchers, desert sparrow hawks, cactus wrens, and western martins. Among all this interesting collection of nesting birds, we found two families of saguaro screech owls, each with two young nearly half grown, on May 21. The next day we saw evidence of overcrowding in this thickly settled community of nesting birds; we saw an elf owl looking out of one of these holes, but when we chopped it out, we were surprised to find a screech owl sitting on three elf owl's eggs.

So far as I can learn, the saguaro screech owl has never been found nesting anywhere but in the giant cactus (*Cereus giganteus*), and only where this cactus grows in the lowlands. Herbert Brown told Major Bendire (1892) that he had found them "nesting in holes of sahuaras within 4 feet from the ground, and from that distance up to almost the extreme top of the plant. The sahuaras along the river bottoms, and on the mesas bordering them, are their favorite nesting grounds." He cut down a number of large saguaros in other places, at higher elevations, that were bored full of woodpeckers' holes, but never found any owls in any of them; so he concluded that these owls nest only in the saguaros "growing in the lowlands and not those in the higher hills or out in the deserts."

Eggs.—The saguaro screech owl lays three to four eggs. These are like the eggs of other screech owls but smaller than those of the larger races. The measurements of 11 eggs average 34.1 by 29 millimeters;

the eggs showing the four extremes measure **35.5** by 29, 35 by **30**, and **32.5** by **27.5** millimeters.

Food.—Mr. Brown (Bendire, 1892) says: "Small birds, kangaroo rats, gophers, different species of mice, lizards, scorpions, grasshoppers, and beetles are their staple articles of diet."

Mrs. Florence M. Bailey (1923) found one in a cottonwood stub on the bank of the Santa Cruz River and says: "The pellets taken from the cavity contained bones of wood rat, kangaroo rats, pocket mice, deer mice, and a grasshopper mouse, the skull of one young *Neotoma albigula*, numerous jaws and bones of *Perodipus ordii* and *Dipodomys merriami*, together with a few jaws of *Perognathus eremicus*, *Peromyscus eremicus* and *sonoriensis*, and *Onychomys torridus*."

Voice.—Dr. Loye Miller (1928) says of some that he heard repeatedly:

> When whistling they invariably occupied a perch less than five feet from the ground, in dense willow tangle grown up from beaver cuttings to a height of twenty feet or more. Out of the midst of this brush, birds were repeatedly called (or stimulated or what you will) by imitating the whistled note. They came out into the moonlight and circled my body so closely that the faint bat-like flutter of the wings was plainly audible and one bird perched within two feet of me, where it was clearly visible in the moonlight. Otherwise they always returned to the depth of the thicket where the two birds collected were searched out with the electric flash light.
>
> The song (?) of all individuals was the same in its composition, though the absolute pitch might differ by a major third. The composition of the performance differed from the customary note of the race of the San Diegan district (*Otus asio quercinus* Grinnell) in being made up of two tetrads of notes of equal tempo but with the first one pitched a half tone above the second. The final note of the second tetrad slides down to a slightly flatted pitch. I heard no other whistle from the Colorado River birds.

OTUS ASIO XANTUSI (Brewster)

XANTUS'S SCREECH OWL

HABITS

This small, pale screech owl is known only from the southern part of the peninsula of Lower California, Mexico. Dr. Joseph Grinnell (1928b) says: "Common resident in the Cape district, whence reported from many localities, all south of La Paz. Apparently occurs from the coastal lowlands (Arid Tropical life-zone) up to the tops of the Victoria Mountains."

William Brewster (1902) in naming it, describes it as "most nearyl like *M(egascops) vinaceus* Brewster, but smaller, the general coloring paler and less reddish, the crown and outer surfaces of the wings lighter, the primaries with broad, well-defined light bars on *both* webs, the abdomen and flanks decidedly whiter, the under tail coverts nearly pure white and practically without mesial streaks, the feathering of the legs shorter and sparser."

Ridgway (1914) describes it as "similar to *O. a. cineraceus* but vermiculations of upper parts finer and blackish streaks narrower, size smaller, and toes more scantily feathered."

Laurence M. Huey (1926a) has described a new race from Lower California, which he has named *Otus asio cardonensis*. The characters given are: "Nearest to *Otus asio cineraceus*, but darker, especially about the head and neck, where the striping is more pronounced. Averages smaller than *O. a. cineraceus* and larger than *O. a. xantusi.*" He gives as the range: "As far as known, the giant cactus (*Pachycereus*) association of the Pacific slope of Lower California from the vicinity of the hills east of Santo Domingo and San Quintin to the region lying east of El Rosario."

Dr. Louis B. Bishop evidently thinks this is a good race, for he writes to me: "*O. a. cardonensis* is the size of *xantusi* but darker than it or *gilmani*, approaching *cineraceus* below, though not quite so heavily streaked and basal portions of feathers paler; browner above than *cineraceus;* more heavily streaked above than *gilmani* and *xantusi*, less so than *cineraceus*."

Griffing Bancroft sent me a small screech owl, collected at San Ignacio with a set of two eggs, which he called *xantusi*. I compared it with our good series of *xantusi* and *cineraceus* at Cambridge and referred it to the latter, which it seemed to match quite closely; it certainly is not *xantusi* but may be referable to *cardonensis*, which I have not seen. The two eggs that were collected with it measure 32.6 by 27.9 and 31.8 by 26 millimeters, somewhat smaller than the average for *cineraceus*.

J. Stuart Rowley says in his notes on Xantus's screech owl: "These birds were rather plentiful about our camp in Miraflores; from about dusk until 9 o'clock in the evening screech owls were heard calling noisily. From that time on the owls became quieter—no doubt food hunting and not courting. More than a dozen specimens were taken, most of them from woodpecker holes in cardons, while we were going through the routine of ladder climbing and chopping from cardon to cardon."

Nesting.—Mr. Rowley took five sets of eggs, in various stages of incubation, near Miraflores from May 11 to May 20, 1933. He says in his notes: "The nesting cavities were old woodpecker holes in cardons, usually about halfway up one of the arms, or 15 to 20 feet from the ground, but one set of two was taken from a hole only 10 feet up. In each case, where a nesting female was taken, the male was either in another hole in the same cardon or as near as he could get to it in the nearest cardon. No signs of food remains were noted. An occupied hole could usually be detected by a telltale feather caught on the edge of the entrance."

Eggs.—Xantus's screech owl evidently lays two to four eggs. Mr. Rowley took one set of four, two sets of three, and two sets of two. They are like other screech owls' eggs but smaller than those of the larger races. The measurements of 14 eggs average 34.2 by 29.3 millimeters; the eggs showing the four extremes measure **35** by **31** and **32** by **27** millimeters.

Plumages.—Dr. Bishop tells me that *xantusi* has two color phases, showing about the same degree of difference as exists in the two phases of *trichopsis*, that the brown phase predominates, and that in this phase the upper parts are "wood brown" or lighter; in the gray phase, *xantusi* is the palest of the southwestern races, a trifle paler than *gilmani*, and less heavily streaked above and below.

OTUS TRICHOPSIS (Wagler)

SPOTTED SCREECH OWL

HABITS

The spotted screech owl superficially resembles, in its gray phase, the other screech owls in the region it inhabits, from the mountains of southern Arizona southward through Mexico to Guatemala. But, on close examination, it is readily seen to be a distinct species, and not a subspecies of *Otus asio*. This species is decidedly dichromatic, having very distinct gray and red phases, which is not true of any of the southwestern races of *Otus asio*.

Both phases are quite distinct even in the downy, juvenal plumages; these and the two adult phases are fully described by Ridgway (1914), but his account is too long to be quoted here. The most conspicuous characters by which the species can be recognized are the large white spots on the lower hindneck and on the scapulars and greater wing coverts, the large black spots on the under parts, and the greatly developed bristly tips to the feathers of the face.

We are indebted to Edouard C. Jacot (1931), who for ten years has braved the hardships and dangers of night work in the mountains of southern Arizona studying the screech owls, for most of our knowledge of the habits of these elusive birds. He says that "this year fifty nights were spent in the field and some twenty square miles of country were worked." Having spent some time with him in the Huachuca Mountains in 1922, I can appreciate the difficulty of this work.

As to the range of the spotted screech owl, he says that it "is a permanent resident in the Huachuca Mountains. * * * This is evidently a bird of the Arizona white oak (*Quercus arizonica*) belt, and none was taken outside of this region, all having been secured between 5,500 and 6,500 feet elevations."

Courtship.—Jacot gives the following interesting account of the mating calls of this owl:

I was almost certain that a pair of Spotted Screech Owls was nesting in the vicinity of my camp, as the male had been heard several times during the month. Another male arrived one night and passed on, acting like the wandering males earlier in the season. About a week later the worried *choo-you—coo-coo* notes of the pair attracted my attention. Working carefully toward them, I realized that both birds were giving this call, and I was also surprised that both birds were coming toward me. The female gave the *chang* note almost continually, and gave the longer call only twice after the two birds were located. The male also gave the *chang* note a few times. He flew within a few yards of me, lit on a green limb of a white oak, well out near the end, and continued to call *choo-you—coo-coo.* The male was taken. The female did not call after the shot, but I was able to follow and watch her for a short time. Six nights later, a male giving the mating song was taken within seventy-five yards of the place where the pair had first been seen. The following night the mating call was again heard in the same locality, the owl calling about twenty yards from the place where the first male had been secured. Another owl was answering farther up the cañon, and it was noticed that the notes of the calling bird were higher pitched than those of the answering bird. Thinking the bird nearest me was a male, I shot it. This owl, however, proved to be a female in brooding condition. I believe that this female would have had three different mates during the week if she had not been killed. The males thus attracted are probably year-old males, which have not mated and are wandering singly over the country.

Nesting.—I can find no published account of the nesting habits of this owl that I am willing to accept as authentic. M. French Gilman (1909) found screech owls "rather numerous" and breeding, along the Gila River in Arizona, which he called spotted screech owls (*Otus trichopsis*). But this locality is far from the known range of *trichopsis*, which is known to breed, in Arizona at least, only in the white-oak association in the mountains between 4,000 and 6,500 feet elevations. Moreover, he does not mention *cineraceus* or *gilmani* (if the latter is recognizable), one of which is the common breeding screech owl of the Gila River region. Furthermore, there was some earlier confusion in the nomenclature of these owls, which may have misled him.

There are two apparently authentic sets of eggs of the spotted screech owl in the Thayer collection, taken by Virgil W. Owen in the Chiricahua Mountains, Cochise County, Ariz. The female parent was taken with both sets, one of which I have examined. The first set of three fresh eggs was taken on May 6, 1906, at an altitude of about 5,300 feet; the female was dissected and found to have finished laying. The nest was in a natural cavity in an oak tree, about 18 feet from the ground. The eggs lay upon some oak leaves in the bottom of the cavity, 14 inches below the entrance.

The second set of four eggs, in which incubation was well advanced, was taken on May 1, 1907, in the same locality. The nest was at the bottom of an old flicker's hole, the entrance of which was 18 feet from the ground in the trunk of a large wild walnut tree. The eggs were deposited on bits of decayed wood, 10 inches down from the entrance. The female parent of this set was caught on the nest and is now in the Thayer collection.

Since the above was written Herbert W. Brandt has sent me the following notes, in advance of publication, based on his experience with the nesting of this owl in the Huachuca Mountains, Ariz., in 1936: "We were fortunate to find two nests of this very rare bird, one on May 8, with three highly incubated eggs, and on the following day a second set of the same number in which incubation had just begun. The first nest was located 22 feet up in an apparent flicker hole in a dead juniper stub growing at an elevation of about 5,900 feet, in the bottom of Sunnyside Canyon. The incubating bird left its retreat when Jacot struck the tree sharply, but returned almost at once and was captured on the nest. The three globular white eggs were found, partly buried, at the bottom of the 16-inch cavity.

"The second nest was found by the same method as the first. In this case the bird had selected a large sycamore tree growing at an altitude of about 6,300 feet, which is here the higher limit of the Upper Sonoran Zone in Bear Canyon. The bird chose an open cavity formed by the breaking out of a main limb, in which to lay its three white eggs. No lining for the nest was employed, the eggs simply being deposited on the accumulated debris. The site was open above, and so formed that the sitting bird could look out without effort and observe that which occurred at a large spring below. This owl was collected also, and at each nest, the incubating bird proved to be a female."

Eggs.—The eggs of the spotted screech owl are similar to the eggs of other screech owls but are somewhat smaller. The measurements of the 13 eggs in the four sets referred to above average 33 by 27.6 millimeters; the eggs showing the four extremes measure **34** by 27.2, 32.3 by **29**, **31.9** by 28.7, and 32 by **26** millimeters.

Plumages.—Specimens of this rare owl are very scarce in collections. I have seen only one specimen in immature plumage. This species is decidedly dichromatic, even in the juvenal plumage. Ridgway (1914) describes both adults and young of both phases quite fully, to which the reader is referred. Of the young in the gray phase, he says: "Upper parts dull grayish brown, indistinctly barred or transversely mottled with dusky and dull grayish white, the latter on tips of the feathers; under parts dull white, broadly barred with grayish brown."

The young in the rufescent phase he describes as "upper parts as in adults but black streaks indistinct (obsolete in some places); under parts pale cinnamon-buff deepening into light cinnamon-rufous on chest and throat, the breast, sides, and flanks with narrow and indistinct bars of dusky."

The gray phase is apparently much commoner than the rufescent. In the gray phase of adults, the general color of the upper parts is "brownish gray, coarsely vermiculated with dusky, broadly streaked with black"; and in the rufescent phase, adults are "above light dull cinnamon-rufous, relieved by conspicuous mesial streaks of black", according to Mr. Ridgway (1914). He says further: "The color (rufous) is much lighter and duller than in the rufescent phase of *O. asio* and its subspecies, and with the black streaks more conspicuous."

Food.—Mr. Jacot (1931) writes: "Black crickets, hairy caterpillars, moths, grasshoppers, large beetle larvae, and centipedes form the principal diet of the Spotted Screech Owl. Moth eggs, undoubtedly taken from the female moths, were found in two stomachs, and a large spider was found in another. Caterpillars and black crickets are staple articles of their diet the year round. Centipedes are taken more frequently during the winter months than during the summer. Practically every stomach examined during the colder months contained one or more small centipedes."

He tells me, in a letter, that one stomach that he examined "contained nine fuzzy caterpillars, seven black crickets, and two centipedes."

Of the five specimens collected by Berry Campbell (1934) at Pena Blanca, Arizona, the "stomach contents were as follows: nos. 190, mantis and grasshopper; 189, mantis, grasshopper, and centipede; 2269, 2 *Stenopelmatus*, 2 caterpillars, and one very large beetle; 2007, 2 large hairy caterpillars and one vinagerone; 2269, beetle remains, finely broken. The presence of *Stenopelmatus*, or mole cricket, indicates that these owls must feed from the ground, in part at least. I have observed them on the ground only once."

Behavior.—Mr. Jacot (1931) writes:

> The Spotted Screech Owl is seldom seen above thirty feet from the ground in any species of tree, and usually ranges below fifteen feet. The birds prefer the Arizona white oak to all other trees, but they were also observed to frequent the alligator-barked juniper, sycamore, Emory oak, mountain ash, and to some extent the walnut. The pine seems to be the least favored of the trees in the region although it is not uncommon. I have only one record of a Spotted Screech Owl frequenting a pine. This was a small sapling, with its branches intermingled with those of a small white oak, and the owl retreated into it at my approach.
>
> The plumage of the Spotted Screech Owl blends admirably with the bark of the Arizona white oak in daylight or at night. The owl during the day perches at times on a branch close to the trunk of the tree. In this situation, with its eyes closed and hiding the yellow iris, and stretched to its full height, it resembles the dead stub of a branch. This screech owl does not attempt to escape observation at night in this way, but when it is on a large limb, it fluffs out its feathers and leans forward in such a manner that it looks very much like a bulge on the limb. Occasionally, one will be seen perched near the end of a branch among the twigs. In this position, it inclines its body toward the end of the branch and

closely resembles a cluster of leaves. Whether this posture is assumed to avoid detection, or is merely a position preparatory to flight, could not be determined, as, although the owls often hold this position for several minutes, they do not always fly.

Voice.—Mr. Jacot (1931) says of the calls of this owl:

> The mating song or call of the male consists of about six rapidly delivered notes. These notes sound very much like *boo* or *boot*, and are delivered about as fast as a person can count: *boot-boot-boot-boot-boot-boot*. The male may be heard calling a half mile or more away, but at times the call may be uttered so softly that the sound carries only a few feet. The female also gives the mating call in an emergency, but at a higher pitch.
>
> There are several alarm notes used by both the male and the female. A worried *chang* is most frequently given, especially by the female. A rather mournful *choo-you—coo-coo* is uttered when the owls are greatly disturbed. They also snap their bills as other screech owls do. Both birds give clucking notes while courting, or when one or the other of the owls flies into a tree where its mate may be.

Mr. Brandt says further, in his notes: "We found the spotted screech owl to be not uncommon in Sunnyside Canyon, where a pair dwelt about every mile or so. As soon as it becomes dark, this little bird begins to bark its four, even-pitched notes that are more doglike than those of the screech owl. It is tireless in its refrain, which may continue uninterrupted for an hour or more, usually coming down from well up on the canyon side. His voice is gentle, yet has far-reaching power, and somewhat resembles the sound produced by blowing across the opening of a bottle. On one occasion a spotted screech owl, from high up on the mountainside, was singing incessantly his nocturnal calls. As it was a long climb up to meet him, it was suggested that we try to lure him down to us by squeeching. Very promptly, after the first few squeeches, his answering voice was notably louder, hence we surmised closer, and before long, like a shadowy bat in the darkness, he alighted in a tree only 5 feet over our heads."

A. J. van Rossem (1936) adds to our knowledge of this rare owl, as follows:

> About 9 o'clock on the evening of June 4, 1931, the notes of a small owl were heard in the sycamore and oak timber along the stream which runs past the resort in Madera Cañon in the Santa Ritas. These notes, while unmistakably "screech owl" in character, were very different in cadence from those of any member of the *asio* group covered by my experience. They consisted of a repetition of three short notes, a slight pause, and a fourth, terminal note, "– – – –, – – – –, – – – –, – – – –, – – – –." A whistled imitation soon decoyed the caller, which proved to be a Spotted Screech Owl, within range. On June 5, a night trip of several hours' duration pretty well prospected Madera Cañon between the resort at 5500 feet altitude and Littleshot Cabin at 7000 feet. Among other nocturnal rarities encountered, Spotted Screech Owls were located, by the unmistakable call notes, at five different points and by calling the birds from a central location I had four individuals close to me at one time.

DISTRIBUTION

Range.—Southern Arizona south through Mexico to Guatemala. Nonmigratory.

The range of the spotted screech owl extends **north** to southern Airzona (Huachuca Mountains and the Chiricahua Mountains). **East** to southeastern Arizona (Chiricahua Mountains and the Huachuca Mountains); Chihuahua (Carmen); Durango (Rio Sestin); Mexico (Chimalpa and Ajusco); Puebla (Zentla); and Guatemala (Uspantan, San Lucas, and Villanueva). **South** to Guatemala (Villanueva, Joyabajo, and Chichicastenango); Oaxaca (La Parada); and Guerrero (Omilteme). **West** to Guerrero (Omilteme); Michoacan (Patzcuaro); Jalisco (Los Masos and La Pisagua); Nayarit (Sierra Madre); and Arizona (Huachuca Mountains and Chiricahua Mountains).

Egg dates.—Arizona: 4 records, May 1 to 9.

OTUS FLAMMEOLUS (Kaup)

FLAMMULATED SCREECH OWL

HABITS

This pretty and gentle little owl is now known to be quite widely distributed in mountainous regions from southern British Columbia and Idaho southward through Mexico to the highlands of Guatemala. It was first added to our list by Capt. John Feilner, who obtained a single specimen, a young bird, near Fort Crook, Calif., on August 23, 1860. Its nest was not found until June 15, 1875, when Charles A. Aiken took a single egg in Wet Mountain Valley, Colo. It is still one of the rarest of our owls and scarce in collections.

Harry S. Swarth (1904) evidently considered this owl as mainly a migrant in Arizona, though it is well known to breed there, for he says:

> Although the Flammulated Screech Owl is quite a common migrant in the Huachucas some years, I believe that but very few remain to breed, the bulk of them going farther north. In 1896 eight, and in 1902 seven, specimens were secured; and of these, I believe all but one were migrating birds. * * * The earliest secured was on April 22, 1902, and the latest on May 12 of the same year. All were shot where they were sitting in the trees, usually in dense thickets almost impossible to penetrate; and this fact may perhaps account for so few specimens of this bird being taken, as quite half of those secured were found while searching for the nest of such birds as bred in the thick brush. On May 5, 1902, O. W. Howard secured two females in some willows on the San Pedro River, fifteen miles from the mountains and an exceptionally low altitude for this species, about 3000 feet. The breeding bird mentioned was taken at about 8000 feet elevation; and all the others, from the base of the mountain (about 4500 feet) up to 6000 feet.

A. J. van Rossem (1936) found the flammulated screech owl breeding in the Santa Rita Mountains, Arizona: "At Littleshot Cabin, in the mixed oaks and pines at 7000 feet, a male was collected at dusk on

June 6, 1931, as he was flying about through the trees. This bird was not at all shy and decoyed readily to a squeak."

Nesting.—Major Bendire (1892) quotes William G. Smith, on three nests found by him, as follows:

> The first nest was taken on June 2, 1890, in Estes Park, Colorado, at an altitude of probably 10,000 feet. The site, a Woodpecker's hole in a dead aspen, was about 10 feet from the ground and the burrow about 10 inches deep. It contained three fresh eggs. The female, which was in the hole, had to be removed by force, and in doing so one of the eggs was broken; they were lying on a few chips and feathers from the bird.
>
> On June 4, I found a second nest about a mile from the former site and in a similar situation, a ravine near water. This contained two fresh eggs and an egg of a Flicker (*Colaptes cafer*). They were placed in a Woodpecker's hole in a large aspen, about 8 feet from the ground and 10 inches below the aperture, while about 6 feet above this was a nest of young Flickers. The cavity appeared to have been formerly used by a squirrel and the eggs were deposited on the old nesting material. It also contained a few Flicker's feathers. The female clung tenaciously to her eggs.
>
> On June 20, I found the third nest, but this time at a considerably less altitude, probably about 8,000 feet. It was in a pine tree in a Woodpecker's hole about 14 feet from the ground, and contained four partly incubated eggs. On rapping the tree the old bird flew out and perched on a limb close by while I investigated the nest. This consisted of a few feathers in the bottom of the burrow, which was about 10 inches deep.

Frank C. Willard (1909) took a set of three fresh eggs, on May 18, 1909, near the summit of the Huachuca Mountains, at the head of Ramsay Canyon, Arizona. He says:

> The eggs in the set were fresh and were lying on the chips in the bottom of the cavity, which was twenty-five feet up in a pine stub. The growth at this point consisted of scattering pines and firs. The altitude was 7,700 feet.
>
> On May 30 I started another female *flammeola* from her nest in a Flicker's hole, twelve feet up in an oak tree growing in the bed of a canyon on the west slope of of the Huachucas, at an altitude of 6,000 feet. I left the two eggs and returning June 11 secured the full set, incubation well along. The bird left the nest as I climbed up, and alighted on a drooping branch near the entrance. I dropt down and, picking up my camera, secured a snap shot at a distance of eight feet, immediately after which she flew away. It was a very comical picture she made as she sat there, opening first one eye and then the other, like a sleepy child, in an endeavor to accustom herself to the glare of the bright sun.

Mr. van Rossem (1936) found a nest containing young, on June 9, 1931, in the Santa Ritas, in an old flicker hole 10 feet up in a dead pine.

Eggs.—The flammulated screech owl lays three or four eggs; these are about oval, the shell is finely granulated and slightly glossy, and the color is white, with a faint creamy tint. They are about midway in size between the eggs of the elf owl and those of the Mexican screech owl.

The measurements of 38 eggs average 29.1 by 25.5 millimeters; the eggs showing the four extremes measure **32.1** by 25.1, 30.2 by **26.5**, **27.9** by 25.4, and 28 by **24** millimeters.

Plumages.—Mr. van Rossem (1936) says: "Two newly-hatched young collected on June 9, 1931, are thickly covered with snowy white down, with, in life, the bills and feet flesh color. The irides, both of adults and young, were very dark, nearly blackish, brown—very different from the yellow irides of the common and spotted screech owls."

Baird, Brewer, and Ridgway (1905) describe the "first full, but imperfect plumage" as follows: "Wings and tail as in the adult (last pale band of latter apparently terminal). Whole head and body with numerous, about equal, transverse bands of dusky and grayish white; the two colors about equal, but on lower parts both are much wider and more distinct than above the white gradually increasing posteriorly. Breast and outer webs of scapulars with a rusty tinge, the latter scarcely variegated. Eyebrow white, feathers bordered with dusky; eye-circle and ear-coverts bright rusty-rufous; lores much tinged with the same. No facial circle."

In the adult plumage there is considerable individual variation between the two extremes of the gray and red phases, of which Mr. Ridgway (1914) writes:

> The individual variation in this species is so great that it is somewhat difficult to frame a description covering them all. The variations involve not only the general color (extreme examples of the grayish phase being without a trace of cinnamomeous or ochraceous color, except the partly buffy outer webs of exterior scapulars, while extremes of the rufescent phase have cinnamon-brown and cinnamon-rufous the predominant colors), but also the size of the darker markings on the under parts, which may consist of delicate pencilings or heavy spots and bars. So far as I am able to see, these variations are utterly without geographic significance, except that the extreme rufous phase is, at present, known only from Guatemala, where, however, specimens occur which I am unable to distinguish from northern examples.

Food.—The flammulated screech owl is apparently largely, if not wholly, insectivorous, though it may occasionally capture a small mammal or bird. In the few stomachs that have been examined have been found various beetles, moths, grasshoppers, crickets, caterpillars, ants, other insects, spiders, and scorpions.

Behavior.—Edouard C. Jacot (1931) says of the habits of this owl in the Huachuca Mountains of Arizona:

> The pine trees seem to furnish the favorite perches from which the Flammulated Screech Owls call, and the Arizona white oak is a close second. They were also heard calling from sycamore, Emory oak, madroña and thick oak brush, having flown into the latter on several occasions when disturbed and continued to call. The owl, in calling from a pine tree, is usually to be found about two-thirds the height of the tree, perched on a live limb near the trunk. In a white oak, the calling bird may be perched on the bulge of the trunk or near the trunk on a live limb, and at times well out near the twigs, but I have seen it only once on the dead stub of a branch. Usually, the Flammulated perches near the trunk of the tree

from which he may be calling, and there may or may not be intervening branches between the bird and the ground.

> In my experience, the Flammulated is the shyest of the screech owls at night, and is adept at keeping some obstruction between itself and the observer, although a given individual may not be consistent in this. It is greatly assisted in avoiding detection by the color of its plumage. The owl's back blends perfectly with the bark of the pine tree, and the markings of its underparts with that of the white oak at night, so that it is almost invisible when it is perched with its back toward the stem of the tree.

Mrs. Florence M. Bailey (1928) writes: "The bird which Mr. Ligon collected in 1920 was at the time 'sitting on the loose fine rock of a slide, under thick brush.' On the Indian School campus at Santa Fe, Mr. Jensen found one sleeping in a peach tree in the orchard, and another dead under a light wire. One found by Mr. H. H. Kimball in the San Francisco Mountains was roosting in a road-camp 'garage, made out of upright pine poles roofed with galvanized iron,' in which a three-ton truck was kept. As Mr. Kimball remarks, 'evidently it had found the semi-darkened interior of the building a satisfactory resting place during the day.' "

Voice.—Mr. Jacot (1931) says:

> The mating song is composed of two notes: *boo-boot.* The second note is accentuated and louder than the first. This song is usually given at regular intervals so that it becomes monotonous. However, at times, when a bird's attention is attracted, the song may be uttered at irregular intervals. The *boo* note is often dropped and the *boot* note given alone. At such times, this note may be considered by the birds as a note of warning. The mating song of the Flammulated Screech Owl is the most ventriloquial owl call I have ever heard.
>
> The male, and I believe also the female, when apprehensive, utters a mewing note, very much like that of a kitten, and almost identical with a warning note of the Elf Owl. In courting, both birds make clucking noises, and upon rare occasions one of the birds (it was not determined which) utters a screech which with a little more volume would be "blood-curdling".

Dr. Joseph Grinnell (1908) writes:

> On the evening of July 15, 1905, at Bluff lake, I obtained an adult male specimen of this rare species. During the preceding two evenings we had repeatedly heard a peculiar note, different from that of any other owl we had ever heard. It consisted of a single mellow "whoot," repeated at regular intervals, something like the call note of the phainopepla in this respect. These notes began to be heard at early dusk, by seven o'clock; but on account of their ventriloquial quality gave little clue as to distance. Although far-reaching the notes proved to have been uttered really close at hand. By careful stalking the point of origin was located in the top of a tall yellow pine 200 yards from our camp; and presently a small bird with a true owl silhouette flew across an open space and lit in the top of a tall tree fully 100 feet from the ground. A charge of number 7 shot started it down and after a few minutes lodgement, it fell to the ground at my feet, my first and only specimen of the dwarf screech owl, and one of the rarest birds in California.

Field marks.—The small size of this owl, the short, rounded ear tufts, the dark chocolate-brown eyes, and the prettily variegated color pattern of browns, silvery gray, black, white, and cinnamon are all good field marks by which the flammulated can be distinguished from all other screech owls.

DISTRIBUTION

Range.—Western United States and Mexico, south to Guatemala. Casual in British Columbia.

The range of the flammulated screech owl extends **north** to southern British Columbia (Penticton); Idaho (Fernan and Ketchum); central Utah (Boulter); and northern Colorado (Estes Park). **East** to Colorado (Estes Park, Idaho Springs, Fountain Creek, Copper Gulch, Beulah, and probably Mosca Pass); New Mexico (Carson Forest, Santa Fe, and Haut Creek); possibly western Texas (Dog Canyon, Guadaloupe Mountains); Veracruz (Mount Orizaba); Chiapas (San Antonio); and Guatemala (San Geronimo and Duenas). **South** to Guatemala (Duenas and Tecpam); and the Federal District of Mexico (Chimalpa). **West** to the Federal District of Mexico (Chimalpa); Arizona (Huachuca Mountains, Camp Apache, and Grand Canyon); California (San Gabriel Mountains, Monache Meadows, Bigtrees, and Fort Crook); Oregon (Hart Mountains); Washington (Kiona); and British Columbia (Penticton).

The birds of the southern part of the range have been separated into a geographic race known as *Otus flammeolus guatemalae* Griscom, but little is known concerning the dividing line between it and the typical race to the north.

Egg dates.—Colorado: 11 records, June 2 to 27; 6 records, June 5 to 20, indicating the height of the season.

Arizona and New Mexico: 5 records, May 18 to June 11.

BUBO VIRGINIANUS VIRGINIANUS (Gmelin)

GREAT HORNED OWL

PLATES 68–75

HABITS

As an introduction to this grand species, I cannot do better than to repeat the following well-chosen words of Ernest T. Seton (1890), which so well express my own sentiments: "My ample opportunities of fully observing these interesting birds in captivity as well as in a state of freedom, and indeed all that I have seen of them—their untamable ferocity, which is daily more apparent; their magnificent bearing; their objection to carrion, and strictly carnivorous tastes—would make me rank these winged tigers among the most pronounced and savage of the birds of prey."

The great horned owl, with its various subspecies, is widely distributed throughout the timbered regions of North, Central, and

South America, from the Arctic regions in the North to the Straits of Magellan in the South. Many races have been described, but only those included in the latest Check-List (1931) will be considered in this work.

Our eastern race particularly is essentially a bird of the heavily forested regions, where it finds seclusion and ample food supply in the dense, dark woods. Where there are extensive forests, well stocked with small game, it is a common bird, but it is also found in lesser numbers where scattered woodlands still remain and where it can prey on poultry yards and game preserves. In my local territory, in southeastern Massachusetts, the distribution of the great horned owl coincides with that of the red-tailed hawk; I have always considered these two as complementary species, one hunting by night and one by day in the same region; the same relation seems to exist between the barred owl and the red-shouldered hawk. We usually find the great horned owl nesting in old nests of the red-tailed hawk, but I have never found these two species nesting in the same tract of timber simultaneously, as the barred owl and the red-shouldered hawk often do. I believe that the great horned owl will not tolerate the nesting of any other raptorial bird anywhere near its own nest.

Courtship.—During the January thaw, or on the first soft, warm evenings in February, we used to listen for the love songs of these owls, for they start their preparations for nesting very early in the season, and they are very noisy at this time; their prolonged hootings at this season have often helped to locate a nesting pair; but I have never been fortunate enough to see the courtship performance. Dr. Lynds Jones wrote to Major Bendire (1892): "I once had the good fortune to steal unnoticed upon a pair of these birds in their love making. The ceremony had evidently been in progress some time. When discovered the male was carefully approaching the female, which stood on a branch, and she half turned away like a timid girl. He then fondly stroked his mate with his bill, bowed solemnly, touched or rubbed her bill with his, bowed again, sidled into a new position from time to time, and continued his caresses. All these attentions were apparently bashfully received by the female. Soon thereafter the pair flew slowly away side by side."

Floyd Bralliar (1922) gives the following account of it:

> So he began bowing his head, ruffling his feathers, raising his wings and spreading his wings in a curious manner. * * * Aside from watching his antics, she took no notice of his presence. Growing more earnest, he began hopping from branch to branch, continuing his maneuvers and snapping his bill fiercely as if to show that even tho he was not so large as she, what he lacked in size he made up in bravery.
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> Finally, he attempted to approach and caress her but she ruffled her feathers and rebuked him sharply. He took flight, sailing up and down, around and around, evidently doing all the stunts of his race, now and again punctuating his

efforts by snapping his bill. After a few moments he alighted again and began his bowing and dancing all over again.

A rabbit came running down the bank and its white flag caught his eye. Rising in noiseless flight, he sailed downward without the flap of a wing, caught his prey from the ground, glided back into the tree, and presented his offering to his lady love. Apparently, she was convinced of his sincerity. Together they devoured the rabbit, and when he again began his love dance she joined in with as much enthusiasm as he.

Nesting.—The great horned owl has never been a common bird in southeastern Massachusetts. I hunted for 20 years before I found a nest containing eggs. I find only 13 local nests recorded in my notes; four of these were found during one season, 1907; in other years I have never found more than one each year; but during 1933 my companions, Alfred C. Weston and W. George F. Harris, found four nests of this owl in this general region.

All my nests but two were in old nests of the red-tailed hawk; one was in an old squirrel's nest, and one in an old nest of the red-shouldered hawk. All were in the heaviest timber available and as far as possible from human habitations. Nine of the nests were in white pines (*Pinus strobus*), three were in pitch pines (*Pinus rigida*) in a region where no white pines were available, and one was in a large beech tree. The nest in the beech was only 31 feet from the ground, those in the pitch pines were from 38 to 42 feet up, and the white pine nests varied from 40 to 70 feet above ground.

Only twice have I known a pair of the owls to lay a second set after being robbed; these were laid after an interval of three or four weeks, and in both cases the same nest was used for both sets. The great horned owl, according to my experience, does not show the persistent devotion to its nesting area that is shown by the barred owl and, particularly, by the red-shouldered hawk; whereas these other two have been known to nest in the same patch of woods for many years in succession, I have never known *Bubo* to nest in the same tract for more than four years, and this has happened only twice in my experience. My theory is that these owls are such voracious feeders that they exhaust the supply of small game, often within one or two seasons, and have to move to new hunting grounds.

The nest from which I took my first set of eggs, on March 4, 1906, was an old red-tailed hawk's nest, 57 feet from the ground in a tall white pine, located in a swampy hollow in a large tract of heavy timber, pines, maples, oaks, and yellow birches. The nest was made of pine sticks and twigs, was full of dead pine needles, and was lined with short, broken twigs and a lot of buff-colored down from the owl's breast. It rested securely on four large branches, against the trunk and very near the top of the tree (pls. 68, 69). It measured 32 by 22 inches in over-all diameter, the inner cavity was 12 inches in diameter and 2 inches deep, and the outside depth was 8 inches.

The smallest nest that I have seen was in an old squirrel's nest, 52 feet from the ground in the topmost crotch of a tall white pine; it measured only 18 by 16 inches in outside diameter but was deeply hollowed to a depth of 8 inches. The rubbish and dirt had been scraped out, down to the bare branches, and there was no lining except a few downy feathers of the owl.

My most interesting nest was the one in a historic old beech, in a large tract of heavy, mixed timber, which had been the home of a pair of red-shouldered hawks or a pair of barred owls for many years (pl. 41). This nest was built by the hawks and occupied by them in 1907. On April 3, 1909, we were surprised to find that a pair of great horned owls had invaded this territory and taken possession of this nest; this was the first and only time that I have known this owl to usurp a nest of this hawk. The owls had, apparently, brought in some fresh sticks and added a few fresh sprigs of white pine, and the nest was well lined with the downy feathers of the owl; this fresh material may have been added by the hawks, which may have been driven away by the owls after they had started repairing the nest. But *Bubo* did not long remain in possession of this nesting site, for we robbed the nest, and the barred owls appropriated the nest in 1912. In 1913, 1915, and again in 1928, the red-shouldered hawks, probably the original owners of the nest, occupied their old home. Since then the nest has disappeared.

Our experience with this nest was not entirely unique, for other somewhat similar cases of several species using a nest successively have been recorded. John N. Clark (1887) found a pair of Cooper's hawks nesting in the lofty crotch of a large chestnut, near Saybrook, Conn., in 1884; the following year this nest was occupied by a great horned owl, from which he secured a set of two eggs; in 1886 he was surprised to find that a pair of red-tailed hawks had appropriated the nest; and in 1887 he collected a set of barred owls eggs from this same old nest. It was indeed a popular nest to attract four species in four succeeding years.

The great horned owl is our earliest breeder, often laying its eggs in February, and sometimes in January, as far north as New England and New York, a month or six weeks earlier than our largest hawks. It seems remarkable that its eggs should be laid before the snows of winter have gone and while they are likely to freeze if left unprotected; but the reason is obvious when the following facts are considered. The period of incubation is about 28 days, the young remain in the nest about six or seven weeks, and are unable to fly until they are 10 or 12 weeks old; this means that if the eggs are laid about the first of March, as they usually are in this latitude, it will be the middle or last of June before the young are able even partially to shift for themselves. During all this time, and probably for some weeks longer, they must be fed wholly or partially by their parents. They are exceedingly voracious feeders, as the following records will show, their food is difficult to obtain, especially where game is scarce, and it is much easier for their parents to supply their needs before the summer foliage becomes too dense.

Such early nesting requires constant brooding of the eggs during cold or stormy weather; sometimes the nest and even the incubating bird are covered with snow, but the devoted mother generally succeeds in keeping the eggs and the center of the nest dry and warm. Sometimes, however, the eggs are frozen and fail to hatch. C. A. Hawes (1881) tells of a case where the owl, finding that her two eggs were frozen, laid two more in the same nest. "Two of the eggs were in the middle of the nest, and sunk about two thirds their depth into the lining, and were much discolored from being in contact with the wet moss and cedar bark. When blowing them they showed about seven days incubation, but were badly addled. * * * The other two eggs were a trifle smaller, but quite free from any stains, and were quite fresh."

Baird, Brewer, and Ridgway (1905) say: "The mating of this bird appears to have little or no reference to the season. A pair has been known to select a site for their nest, and begin to construct a new one, or seize upon that of a Red-tailed Hawk, and repair it, in September or October, keeping in its vicinity through the winter, and making their presence known by their continued hooting."

Throughout the Middle West, where large tracts of heavy timber are scarce and where the food supply is adequate, the great horned owl nests in much more open situations than it does in New England. Prof. Charles R. Keyes (1911) gives us a full and interesting account of such a nest, found near his home in Mount Vernon, Iowa. A "beautiful deciduous forest" along the Cedar River had been reduced to scattered groves, and in one of the largest of these he had seen the owls. "Soon after, the great oaks and hard maples of the eastern two-thirds of the grove fell under the ax, leaving to the west only a twenty-five acre remnant and, in the cut-over area, only some old white elms and a few young maples and lindens. Among these latter the forest soil soon gave way to a thick carpet of blue grass and so what had been heavy forest was gradually transformed into a rather open and still very beautiful timber pasture [pl. 70]." Of the nest he says:

> It was not in the heavy timber at all but in one of the large elms of the pasture, and, moreover, hardly more than fifty yards removed from the above-mentioned public road where teams were constantly passing. Toward the south the view was wild, open, and picturesque enough; to the west, north and east, at distances varying from 200 to 500 yards, were the schoolhouse and farm houses. * * *

> The nest was in a large shallow hollow, 28 x 32 inches in diameter at the bottom with an entrance 18 x 20 inches in diameter set at an angle of 45° and facing towards the southeast. The hollow was only 8 inches deep on the exposed side, thus permitting fairly good illumination. Of still more importance the nest site was only 22 feet from the ground and a strategic branch some five feet above the nest afforded a point of attachment for a ladder combination from which pictures might be taken. * * * At the very moment when this nest was discovered a second pair of these birds were domiciled in a Redtail's nest placed in a tall white elm in heavy timber three and a half miles to the northwest and just ninety-two feet above the ground.

Thinking that the weather was too cold to keep the owl off her eggs long enough for photography, he pocketed the three eggs that the nest contained on February 17 and relied on her laying a second set; this she did, and on "March 23, three more eggs were found, just like the first and lying in exactly the same little hollow." From that time on a fine series of photographs were taken, and observations made on the life history of these owls.

Major Bendire (1892) says:

> Mr. George E. Beyer, of New Orleans, Louisiana, also found a nest of this species, containing three young, in a hollow pine log on the ground. * * * Mr. Audubon also says that he has twice found the eggs of the Great Horned Owl in fissures of rocks. * * * Col. N. S. Goss, in his "Birds of Kansas," states that on the plains or treeless portions of the State it likewise nests in fissures of rocks. These birds are poor nest builders, and if they do construct one of their own, it is through necessity and not from choice. In the Eastern States the majority use open nests, generally those of the Red-tailed and Red-shouldered Hawks, the Crows, and sometimes those of the larger Herons, while farther west hollow trees, when procurable, are still, to a considerable extent, resorted to. * * *
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> Judge John N. Clark, of Saybrook, Connecticut, writes me that he found a pair of these birds nesting in a quadruple fork of a large chestnut tree some 25 feet from the ground, the eggs lying on the bare wood, without any loose material around them whatever, not even a single leaf. Mr. P. W. Smith, jr., found another pair occupying an old soap box which had been originally put up for squirrels in a grove not over 100 yards from a house. The top of the box had blown off and it was nearly filled with dry leaves.

He quotes Dr. William L. Ralph as follows:

> In the Indian River region of Florida, the Great Horned Owl usually lives in the pine wood districts, breeding altogether in these localities, and I have never known it to nest in other situations in any part of this State that I am familiar with. At and in the vicinity of Merritt's Island, where I visited for several winters, these birds were so common that eight of their nests were found in one season while looking for those of the Bald Eagle, but, like most Florida birds, they are gradually decreasing.
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> In this region these Owls always deposit their eggs in the nests of the Bald Eagle, and while I think that these are usually, if not always first deserted by the original owners, the natives say that the Owls drive the Eagles from and appropriate them for their own use. * * * These nests are originally constructed of large sticks and limbs, lined with dead grasses, palmetto leaves, flags, and weeds—usually with swamp grasses alone—and after being taken by the Owls

> are always further thickly lined with scales of pine bark, a material I have never found in any quantity in the nests occupied by the Eagles. The amount of this bark in each nest seems to be about the same, which would not likely be the case had it fallen into the nests by chance, which may occasionally happen to a limited extent. In addition to this bark there are always more or less feathers from the birds in this second lining. Many birds of prey line their nests with leaves or bark from resinous trees and they do this as a preventive remedy for parasites, with which they are always more or less troubled. * * *
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> These birds become very much attached to certain localities and seldom wander far from them, even in cases of extreme persecution. As a usual thing they will, should their nest be disturbed, take another in the immediate vicinity, and after a season or two return again to the first one; but in this locality I have known one of these Owls to lay a third set of eggs in the same nest from which the first two had been successively taken. In Florida this species usually commences breeding in December. I have taken eggs about one-third incubated December 17, and found nearly fresh ones January 5. These are the earliest and the latest dates of which I have any personal records, and have never found more than two eggs in a nest, and about 60 per cent. of the sets consisted of a single egg.

Donald J. Nicholson has sent me his notes on 14 nests found by him in Florida. Eleven of these were in old nests of the bald eagle, and three were in red-tailed hawks' nests. The earliest date on which he found eggs was December 7, but he found young as early as December 26, which indicated an earlier egg date. In one case, where the owl had preempted a brand new redtail's nest, he flushed the owl off the nest; the owl alighted in the top of a palmetto and was attacked by the hawk, which "dived like a bullet at the thief and gave it a stunning blow", and the "owl flew rapidly away."

Dr. Paul L. Errington (1932a) writes:

> None of the twenty-nine 1930–1932 Wisconsin horned owl nests upon which personal data were procured showed evidence of having been built or remodeled to any degree by the strigine occupants. In practically every case the owls' nest-making instincts seemed satisfied by cleaning out the debris from the immediate bottom of the nesting place and by lining the same with variable quantities of breast feathers. Nest sites chosen were: red-tailed hawk nests, thirteen; crow nests, eight; hollow trees, three; unidentified stick nests, two; holes or crevices in rock faces, two; fox-squirrel nest, one. Nests taken over were usually in secluded locations, the prospective occupants requiring mainly privacy and convenience; in other respects the birds displayed very limited judgment in selecting nests, as four were of such flimsy construction that they disintegrated during the storms or from use, to dump eggs or owlets on the ground.

Herbert W. Brandt writes to me that in Texas they "show a great variation in nesting sites, generally utilizing old hawks' nests, but nests are also found in rocky caves, hollow trees, and, in the prairie region, even on the ground. We found one nest in the long grass near a windmill."

Ivan R. Tomkins tells me that he found two young owls of this species "in a shell hole on the east side of old Fort Pulaski." R. C. Hallman (1929) found a nest on the ground in Florida; "the nest, which could hardly be called one, was placed on the ground, and was composed of a few parts of dry palmetto fans, grass stems and small sticks." Horned owls have also been reported as nesting on the hay in barns and hay barracks, which stood in open spaces and were much frequented; the owners of such places did not disturb them, as they were so useful in destroying rats and mice.

Eggs.—Major Bendire (1892) says:

> From one to five eggs have been found in a set, but as a rule two or three are all that are laid, the smaller number more frequently. In some sections, however, sets of four are not unusual. Mr. J. W. Preston, of Baxter, Iowa, writes me that this number is found by him about once in three sets, and that in the early part of March, 1875, he found a set of five eggs too far advanced in incubation to disturb them, and which were all hatched later. * * *
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> I believe that where the Great Horned Owl nests in hollow trees the number of eggs laid by them is usually apt to be larger than where an open nest is used. The young are more secure in such a location and not so likely to fall or be crowded out. * * *
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> The eggs * * * are white in color, and show little or no gloss, though there are occasional exceptions; they are rounded oval in shape; the shell is thick and rather coarsely granulated, feeling rough to the touch.

Dr. Ralph told Bendire (1892) that 60 percent of the nests he found in Florida contained only one egg. Of the 14 nests recorded by Mr. Nicholson, two contained three eggs, three held only one egg or young, and the others were sets of two. All my Massachusetts nests contained two eggs or two young, never more or fewer. Apparently the large sets are laid in the Middle West, where perhaps the food supply is more abundant.

The measurements of 53 eggs average 56.1 by 47 millimeters; the eggs showing the four extremes measure **59.9** by **50.3** and **50.8** by **43.2** millimeters.

Young.—The following account of the development of young great horned owls is based partially on my own studies of two of the four broods of young that I found in 1907 and partially on the published and unpublished notes of Professor Keyes, E. L. Sumner, Jr., and Dr. Alfred O. Gross.

Two nearly fresh eggs were taken from the Raynham nest on February 18; the owl laid a second set, probably around the middle of March, in the same nest; there were two eggs in the nest on March 23 and on March 31; these eggs probably hatched around April 12. On April 14 the two young owls were but little larger than newly hatched chickens, they were well covered with pure white down, their eyes were not yet open, they were not able to hold up their heads, and were peeping feebly as they nestled under the warm fur of two cottontail rabbits, the fore-quarters of which had been eaten (pl. 72). On April 25 the owl flew from the nest when I rapped the tree, and the young owls, which were now about two weeks old, were about one-third grown; the first coat of white down had been replaced by a coat of dirty, buff-colored down, mottled on the back with dusky; the eyes were open, and the irides were a pale, yellowish hazel (pl. 73). There was no food in the nest but a number of bones. One side of the nest had been beaten down considerably and was soiled with excrement, where the young had been unsuccessful in their attempts to cast it over the side; the odor was rather offensive. On May 5 the old owl was still brooding over her young, standing above them with ear tufts erected, but she flew before I reached the tree. The young were now heavily clothed in fluffy down; their eyes were light yellow, and their primaries were partially out of their sheaths. There was about half of a cottontail rabbit in the nest.

When I visited the nest on May 12, I was surprised to find it empty and considerably dilapidated; perhaps the young were forced to leave it prematurely, for they were only about one month old and would not be able to fly for at least five weeks more. After a short search, we found them huddled together on a rock at the edge of the woods, basking in the sun, two great, fluffy balls of down, hissing and bristling defiantly, if we came too near (pl. 73). I doubted if any fox or other predatory animal would dare to tackle them, as they looked too formidable and seemed well able to defend themselves. Their parents were watching them from nearby trees and were taking good care of them; they had been feeding on a black duck, of which only the bill, a few bones, and some feathers remained. Their wings were not much developed, and their tail feathers were only just bursting the sheaths. How they reached the ground in safety from that 40 foot nest is a mystery; probably their half-developed wings helped to break the fall, and they were tough enough to stand the shock. I never knew what became of them, for on my next visit I could not find them.

The other nest, in Middleboro, was a previous year's nest of a red-tailed hawk, 45 feet from the ground in a large white pine. When we visited the nest on April 7 the two young owls were apparently recently hatched, perhaps one and three days old; their eyes were not yet open, and they were scantily covered with creamy-white down; they were peeping loudly enough to be heard from the ground and were shivering with the cold. The nest was a large, flat platform of sticks, 28 by 36 inches, with no lining except the remains of the old pine needles formerly used by the hawks; piled up around the north side of the nest, as if to shield the young from the cold wind, were the hind quarters of *six* cottontail rabbits, the heads and entrails having been eaten. My next visit was made on April 14, when I found the young owls to be about one-third grown; they could move about in the nest somewhat, and were well covered with buffy, mottled down; their eyes were partly open and were light yellowish hazel (pl. 72). The nest was very dirty and smelled badly of decayed meat and general filth; the food supply consisted of three cottontail rabbits and the hind quarters of an American bittern. The old owls were in attendance, but not on the nest. On April 26 the young were fully half-grown and were about three weeks old; their eyes were now light yellow, and their primaries were bursting the sheaths. The nest contained the remains of a skunk and a cottontail rabbit, and on the ground below it were numerous black-duck feathers. The young now showed fight, bristling up their downy plumage, spreading their wings, snapping their bills, and threatening to attack.

My last visit to the nest was on May 5, when only one young remained in the nest; the other was soon discovered, sitting on a fallen tree about 30 yards away. The young birds were much larger than when I last saw them, being more than four weeks old and nearly fully grown; their backs and wings were more fully feathered, and their tails were well started, but the rest of their plumage was mostly downy (pl. 74). The old owls were very solicitous and were keeping a close watch over their helpless young; but, in spite of their protests, I carried off one of the youngsters for future study in captivity. I placed him in a roomy outdoor cage, with a sheltered compartment, where he lived in apparent contentment for more than two years, and might have lived longer if he had not been convicted of murder and executed. During the latter half of June his wings and tail became sufficiently developed for flight, though his body plumage was still principally downy. In July, he could fly, but it was not until October that he was fully feathered.

The whole nesting period for this species is much prolonged; the period of incubation has been estimated as from 26 to 30 days, but it does not seem to have been accurately determined; Professor Keyes (1911) says that it is not less than 30 days, and probably more. Both sexes assist in it, but I suspect that the female does most of it. The young do not open their eyes for the first week or ten days; they are brooded by their parents for three or four weeks, perhaps more; they do not leave the nest normally until they are four or five weeks old; and they cannot fly until they are nine or ten weeks old. During all this time they are watched, protected, and fed by their parents. Beyond this they follow the old birds about, crying lustily for food, perhaps for many weeks, until they learn to hunt for themselves and are finally driven away, thoroughly weaned, to other hunting grounds far from the place of their nativity. Dr. Paul L. Errington (1932a) writes: "Where does the juvenile go, after it takes up a wholly independent existence? Of thirteen horned owl nestlings (birds that had never been tamed, tethered, or experimented with in any way to reduce their prospects for survival) personally banded in 1930 and 1931, three were reported shot within a year or so, all at points thirteen to twenty miles of where banded."

Clarence F. Stone, of Branchport, N. Y., tells me an interesting story of a pair of young owls that followed their parents about all summer, and even up to the latter part of October, in the vicinity of his camp. He writes: "Almost every night during the month of June 1932, just as the shades of night darkened the woods, two large owls, uttering harsh screams, the like of which I had never heard, came down through the gloomy hemlocks in the bottom of the gully and took perch on lumps of shale, or on the dead fallen trees still clinging to the perpendicular cliffs. In July they changed their route by coming around Chasm Lodge from the upper backwoods of pine and hemlock, where they took perch in the lofty pines and gave vent to rather terrifying and horrid screams. These two owl screamers traveled together, apparently hunting, and alternately uttering the loud, raucous screams that were evidently prompted by the urge of gnawing hunger. Almost nightly during this month, a pair of great horned owls came to hunt and hoot around the lodge. Invariably, a little time later, the two screamers gradually approached the hunting area of the hooting owls. Both the adult pair of hooters and the two screamers had two nighly sessions, first from just at dusk to near midnight and again just before the dawn of day."

Again, on October 20, he writes: "As it was very rainy all the fore part of last night, the hideous screamers did not come to entertain me as usual, but at 4:30 o'clock this morning, I was awakened by the booming hoots of adult great horned owls, and a few minutes later I was fully aroused when the two ferocious screamers suddenly began their harsh yowls in the big pines over the roof of the lodge." On the evening of October 23 the four owls "went on a rampage" again, and he saw the young owls clearly enough to identify them as great horned owls, with well-developed ear tufts, and to see them giving their harsh screams "four to six times a minute." And he says, in conclusion: "In this instance, at least, it seems that the young owls of the year were yet, so late in October, partly dependent on, or at least following, the parent great horned owls about on their hunting excursions. At no time did I hear the adult owls utter anything but the hooting owl language. Only the young owls of the year shrieked the loud, harsh, blood-curdling screams. And I am inclined to believe that these harsh cries were simply hunger screams, characteristic of yearling great horned owls."

Plumages.—When first hatched the young owl is covered with pure-white down, only slightly tinged with grayish buff on the back and wings; this gradually becomes more generally grayish buff during the first week or two, when the secondary, buff, down begins to appear and is fully developed at three weeks of age, with some of the natal down adhering as white tips. This down is long, soft, and fluffy, especially on the thighs, "cream-buff" basally, paling to "cartridge buff" at the tips. Through this down the soft juvenal downy plumage gradually comes in, and this is worn in slowly diminishing areas all summer, or until it is replaced by the first winter plumage early in fall. This is somewhat darker buff, especially on the breast, and is barred with dusky, more heavily on the back and more faintly on the breast; it is long and fluffy, especially on the thighs and rump; on the head the down is short and soft, basally "cinnamon-buff", with pale tips and barred with dusky; the ear tufts are only faintly indicated, and there is much black or dark brown in the facial disks. There is much individual variation in the colors of this plumage, forecasting the color phases of the adult; and the various races show their racial characteristics to some extent at this age. In the meantime the first winter plumage has been pushing out through this downy plumage, first in the wings, then on the back, then in the tail, followed by the rest of the body plumage, and finally on the head. The primaries begin to burst their sheaths at an age of three or four weeks, but the wings are not fully grown until the bird is eight or nine weeks old. In my captive bird, the head, neck, and under parts were still largely downy at an age of 14 weeks; and the full plumage was not acquired until the bird was more than 20 weeks old in September.

This first winter plumage is much like that of the adult but is somewhat more rufous throughout, the ear tufts are smaller, the white throat patch is less extensive and not such pure white, and more or less of the downy plumage persists for some time about the neck and lower under parts. It is worn for ten months or so, until the next annual molt, the first postnuptial. Adults apparently have only one complete annual molt in summer and fall.

Food.—The great horned owl is a ravenous feeder on a great variety of animal life, and a very generous provider for its hungry young; almost any living creature that walks, crawls, flies, or swims, except the larger mammals, is its legitimate prey; it is not at all particular as to what it kills for food and will take what is most available and most easily caught. It is so powerful and aggressive that it can attack and kill surprisingly large mammals or birds. Where its victims are plentiful it often kills much more than it needs, eating only the choicest parts, but where food is scarce it often returns again and again to its kill.

I believe that it prefers to feed on the smaller mammals, mainly those that are active at night, as these are more readily available and easier to catch in its favorite haunts than are birds and poultry; where these are sufficiently numerous, they make up the bulk of the food of this owl. The list of mammals taken includes hares and rabbits of various species, gray, red, flying, and fox squirrels, chipmunks, various rats and mice, including our destructive house species, muskrats, ground squirrels, pocket gophers, spermophiles, minks, weasels, large and small skunks, woodchucks, opossums, porcupines, domestic cats, shrews, and bats. Most of the records indicate that the cottontail rabbit is the most prominent item. Sometimes tracks in the newly fallen snow tell the story of the owl's hunting. Lewis O. Shelley describes it graphically in his notes as follows: "Here on a moonlight night of February, in an open glen away from the dark conifers and near the swamp, several rabbits meet to sport and play, and can be heard squealing, as they hop about and follow their paths at breakneck speed. As their play goes on, a shadow sweeps from the darkness of the hemlocks. And all the rabbits scatter, unmindful of their paths, or freeze in their tracks, their eyes wide, their hearts pounding. By daylight there will be this maze of tracks outside the beaten paths, where a rabbit has darted here and there without coherent thought of destination. At last you find where the tracks end in a circular arena. No tracks lead there save the rabbit's; none lead away. There are bits of fur, to be sure, but that is all. Yet you know that *Bubo*, the great horned owl, has dined to the full, back in the seclusion of the conifers; and *Bubo* leaves no tracks, only bits of fur and sometimes drops of blood."

The great horned owl's nest often smells strongly of skunk, and the birds themselves often retain this pungent odor long after they have been made into museum specimens. G. Norman Wilkinson (1913) relates the following:

> One morning, late in the autumn, I was driving through the woods, when I heard a disturbance in the dry leaves at a little distance from the road. * * * As I drew near, I saw clearly the cause of the disturbance. A few feet in front of me was a large Horned Owl in a sort of sitting posture. His back and head were against an old log. His feet were thrust forward, and firmly grasped a full-grown skunk. One foot had hold of the skunk's neck and the other clutched it tightly by the middle of the back. The animal seemed to be nearly dead, but still had strength enough to leap occasionally into the air, in its endeavors to shake off its captor. During the struggle, the Owl's eyes would fairly blaze, and he would snap his beak with a noise like the clapping of your hands. Neither the bird nor his victim paid the slightest attention to me, though I stood quite close. How long since the Owl had secured the death grip I do not know, but there was no doubt about his having it. The skunk could no more free itself from the Owl's claws than it could have done from the jaws of a steel trap. Its struggles grew less and less frequent and at the end of about fifteen minutes they ceased altogether.

At least three cases have been reported of a horned owl tackling a domestic cat. In one case, the owl found that it had "caught a Tartar," for the cat put up a stiff fight and had to be dropped. Oliver L. Austin, Jr. (1932), tells of a more successful attempt:

> I flushed a Great Horned Owl, which fluttered up in front of my car and flew laboriously down the road. The headlights showed it to be carrying something heavy, something which it could not lift two feet off the ground. I gave chase, and the bird dropped clumsily a hundred yards farther on, to crouch defensively

> atop the prey it seemed so loath to leave. I stopped the car twenty feet away and turned on my strong spotlight. The owl's attention was riveted by the dazzling beam, and while it stood motionless staring into the glare, I crept up cautiously on the dark side, threw my jacket over it, and pinioned it down. After wrapping the claws in my handkerchief to prevent accidents, and folding the bird safely in my jacket, I stooped to pick up its prey, which to my surprise (and delight) proved to be a half-grown house cat. The kill evidently had just been made, for the limp body was still warm and quivering.

Another dangerous animal for this owl to tackle is the porcupine; a strong dose of the barbed quills of this animal might eventually result in the death of the owl. Rev. C. W. G. Eifrig (1909) had one of these owls brought to him that had tackled a porcupine. "It was liberally sprinkled over with quills, especially on the sole of the right foot—the quills having penetrated even that horny skin—under the right wing, on the breast, neck, and even two in the left eye-lid. Some of the quills had pierced the thick, solid muscles of the breast, lying against the sternum. Fifty-six quills and parts of quills were extracted from the skin and flesh, and about ten left in."

The list of birds eaten is a very long one and contains many large species, which are probably attacked under great stress of hunger. It includes pied-billed grebe, several species of wild ducks, Canada goose, tame ducks and swans, American bittern, small herons, American coot, Florida gallinule, king and Virginia rails, red phalarope, Wilson's snipe, yellowlegs, woodcock, various quail and grouse, pheasants, domestic poultry (including turkeys, hens, guinea fowl, and pigeons), mourning dove, marsh, Cooper's, red-tailed, and red-shouldered hawks, barn, barred, long-eared, and screech owls, flickers, sapsuckers, and other woodpeckers, blue jay, crow, starling, blackbirds, meadowlark, snow bunting, junco and other sparrows, mockingbird, and robin.

Great horned owls often visit duck stands and kill the decoy ducks and geese that are tethered on the beaches. They kill also large numbers of grouse in our northeastern forests; I have often found the remains in their nests and evidence of their numerous kills scattered through the surrounding woods. Mr. Shelley says in his notes: "A great horned owl killed a cock ruffed grouse in a piece of woods 50 yards from the house. The grouse was almost entirely and neatly plucked, this being done in two locations 20 feet apart. At the first spot all the small body feathers were stripped off, and at the second spot the wing quills and tail feathers. Here the bird was eaten, and only a few small pieces of broken bone were to be found in the feather refuse. Again, early in the morning of April 23 (six days later), a hen grouse was found about 400 yards from the first killing, also prey of probably the same owl, which is rare here at any season. This time the grouse had been plucked neatly in two locations 12 feet apart; at the latter spot the body had been carried 5 feet farther and placed behind a fire-charred stump after the head, the meat of one leg, and most of the viscera had been eaten. Early in the morning of the 24th, the owl returned to its cache, dragged it to a new spot 10 feet distant, and there completed eating the carcass."

I once had a captive horned owl that I had raised from the nest and kept in my aviary with several other hawks and owls; in the next cage, separated by a chicken-wire partition, was a pet red-shouldered hawk, of which I was very fond, as it would eat out of my hand; one night the owl broke through the partition, killed and partially devoured my pet hawk; the owl soon paid the penalty of a murderer and is now in my collection.

In the middle of a bright day in April, while we were hunting for nests of the red-tailed hawk in the woods of Plymouth County, Mass., we saw a pair of these hawks sailing about over a large tract of pitch-pine timber, half a mile or so distant. Half an hour or more elapsed before we began a systematic search for their nest, when only one of the hawks was seen, circling back and forth over the woods and evidently looking for something. We had not gone far into the pines before we saw a great horned owl fly from a small pitch pine; on closer inspection, we saw a great mass of feathers on a flat branch near the top of the tree; it was apparently the owl's feeding roost, as there were feathers and droppings on the ground beneath. I climbed up to investigate it and was surprised to find the wing of an adult red-tailed hawk which had recently been torn from the body of the victim; the flesh was still fresh and warm. I had no doubt that the owl had just killed one of the hawks that we had seen sailing over the woods less than an hour before.

At least two other similar cases have been reported. Arthur H. Norton (1928) found even more convincing evidence on a nest of the owl that he was studying in Maine; he says: "On the side of the nest rested the wing of a large bird; this proved to be the wing of a red-tailed hawk which had been eaten by the family; feathers were scattered all about the tree, and a mass of other feathers on a bare ledge about seventy feet east south east from the nest showed the place where the victim had been throttled or partly plucked. The wing proved to have been stripped of flesh; and later the legs were found, one in the nest, the other near the crest of the ridge a hundred or more feet to the north north east from the nest, both with the flesh stripped off."

The list of miscellaneous food includes snakes, frogs, dace, goldfish, bullheads, eels, perch, crawfishes, Jerusalem crickets, beetles, grasshoppers, katydids, and scorpions. Mr. Forbush (1927) tells of a man who "came upon a Horned Owl in trouble with a black snake. * * * Plainly the owl had caught the snake, but the reptile had twisted itself around the bird so that it was unable to fly, and fell to the ground with its prey. * * * The Owl had grasped the snake about six inches below its head, but the part of the snake below the owl's talons had twisted itself around the bird tightly. There was at least one light turn around the owl's neck." The snake was killed, though neither antagonist had given up the fight, and "the owl was so weakened and helpless that it could not fly; it seemed to have been choked."

S. A. Grimes (1936) gives an interesting account of struggle between a great horned owl and a large black snake, 46 inches in length. He found the owl "lying on its side with its wings outspread, trying its best to get its talons on a black snake that was coiled around the bird's abdomen just back of the breast bone and beneath the wings. The snake had gotten itself around the owl in a double coil. Six or eight inches of its head and neck and perhaps a little more of its tail were free, but the bird appeared to try only to get hold of the strangling coils around its body. It is easy to see that the bird could not possibly gets its talons on that part of the snake tightly wound around its abdomen, but why the hooked bill was not brought into play is hard to understand." The owl was plainly exhausted but was able to make a feeble flight for about 100 yards, with the snake dangling, and alight on a stump. As Mr. Grimes approached, the owl flew again and alighted on a log in a small pond, where a charge of shot ended the career of both combatants. The owl had evidently attacked the snake, and the slippery reptile, noted for its agility, had somehow eluded the formidable talons and quickly coiled itself around the body of the bird.

The great horned owl, like some other birds of prey, often has a regular feeding roost, to which it brings its prey to be torn up and devoured. This may be an old, unoccupied nest, a wide, flat branch of a tree, the hollowed top of a stump, or a hollow place on a fallen log. Such places are profusely decorated with the remains of the feasts, feathers, bones, fur, pellets, and droppings; they are usually not far from the nesting sites.

Studies of pellets made by Mrs. Bessie P. Reed (1925) showed that they "were usually coated with a thick layer of mucus and never contained any other material save feathers, hair, fur, and cleanly polished bone. * * * Microscopic evidence showed that hair and feathers were in no way affected by the digestive juices, although the quills of large feathers were always splintered and rolled together. On a number of occasions pellets were found that contained hair of two different colors or hair and feathers in which the masses were not mixed at all but were very sharply delimited, indicating that two portions swallowed at different times were not mixed together."

When small birds or mammals were fed to her captive owls, "feathers, hide, and fur were always swallowed, the plucking or skinning process being evidently accomplished in the Owl stomach. These, along with the bones, were rolled into a compact mass and afterwards regurgitated, usually in about twelve hours. When living on an exclusive diet of raw meat from the butcher shop for a few days the birds readily devoured feathers from a plucked chicken in considerable quantities."

That this owl can be a powerful factor for either good or evil, is illustrated by the great quantities of food brought to the nest; I once saw six cottontail rabbits in a nest at one time; Major Bendire (1892) reports a nest that contained "a mouse, a young muskrat, two eels, four bullheads, a Woodcock, four Ruffed Grouse, one rabbit, and eleven rats. The food taken out of the nest weighed almost 18 pounds."

The economic status of the great horned owl depends almost entirely on its surroundings and the kind of food available and its abundance. I am not sure that, generally speaking, it is nearly so harmful as is generally believed; and, in some places, it is certainly more beneficial than harmful. Where rabbits and other small mammals, which it seems to prefer, are scarce, it is forced to live largely on birds and domestic poultry; and probably some individuals develop the poultry habit. Robert Little (1931) reports a case of this; he trapped one of these owls in an extensive poultry yard, and says: "The trap was set in open ground near the chicken pens and was baited with a live pullet tethered to a stake. A few nights before, a small night-box in one of the yards, faced with chicken-wire, had been entered, and 106 pullets (nearly all the box contained) had been killed and left dead. The birds were pierced through the back with what were considered to be talon wounds. * * * A turkey hen also had recently been killed and lesser depredations had been committed."

Raids like this and lesser damage to poultry have given this owl a bad name; but we must make allowance for the fact that such cases are oftener brought to our attention than are the good deeds of the owl in destroying harmful rodents. Furthermore, there have been numerous cases recorded where great horned owls have lived and raised a family in close proximity to farms and poultry yards without molesting the poultry at all, and with no signs of poultry found in their nests.

As to the effect on game birds, Dr. Errington (1932a) writes:

> The Wingra situation, contrasted with that of the Hammersley Slough area, illustrates the bearing of plentiful "buffer species" on the diet of a versatile predator. Up to a hundred Mallard ducks frequented shore-line springs of the refuge all winter, and the lone owl's territory was cohabited by three large covies of quail, yet he was known to get but two (and one of these kills was not unquestionable) quail and no ducks during a four month's sojourn. Why? Because the refuge was over-run with rabbits, and *Bubo* had slight need of ranging very

far in quest of something to eat. On the other hand, the owls of no. 24, finding comparatively "lean pickings" near home, had to take almost anything they could get.

Mr. Forbush (1927) writes: "European Hares had been introduced by someone in eastern New York near the Massachusetts line and had increased rapidly in numbers and spread into western Massachusetts where they had become a serious pest to the farmer and orchardist. In November and December of 1919 a flight of owls came into that region and Mr. Walter Pritchard Eaton told me that numbers were heard about the mountain in Sheffield. There they preyed upon the hares. * * * These owls overran the region and many returned the next winter. The following spring European Hares were very scarce in that country."

To illustrate the value of the great horned owl as a ratter, H. A. Surface (1904) published part of a letter from O. E. Niles, from which I quote as follows: "In the nest where he captured the young owls he noticed several full-grown Norway rats, with their skulls opened and the brains removed. On descending to the ground he also noticed the bodies of many rats around the tree, and out of curiosity counted them, and found the bodies of one hundred and thirteen rats, most of them full grown. They all appeared to simply have had their skulls opened and the brains removed; and from their undecayed appearance, must all have been captured within the previous week or ten days."

Behavior.—The silent flight of the great horned owl is powerful, swift, and graceful. When leaving a perch, it flaps its great wings heavily and rapidly, with its feet dangling; the feet are soon drawn up into the plumage and the wings spread, as it glides swiftly away for a long period of sailing on fixed wings. It threads its way with perfect precision through the branches of the forest trees, or glides at low levels over the open meadows, where it can drop swiftly and silently on its unsuspecting prey. I have several times seen it soaring high in the air on a bright day, with all the grace and power of an eagle or a large *Buteo*, for its eyesight is perfect, and it hunts by day as well as by night.

The strength and endurance of this owl, as well as its failure to learn by experience, are illustrated by a case reported by Dr. Sutton (1929a); an owl was caught in a steel trap but flew away with the trap, which was not securely fastened; two days later the owl was caught by the other foot in another trap set on the same post. Rev. J. J. Murray writes to me of a similar case: "A farmer, who had been losing his chickens and turkeys, set some steel traps in his chicken yard. Hearing a commotion one night, he got out to the hennery just in time to see a large owl fly away with a trap, the chain having been broken by its struggles. A week later the owl returned and the same thing happened, the owl departing with a trap on the other leg. It was later seen flying about with both traps. But, so handicapped, it managed to live and hunt for several weeks, until one of the chains caught in a fence and the bird was killed."

Although, during the season when they have to supply an extra amount of food for the young, these owls are forced to hunt some by day, I believe that at other seasons they prefer to spend the day in seclusion; the thick tops of evergreen trees are favorite daytime roosts; here the owl sits, close to the trunk or among dense foliage, preferably within its breeding territory, its eyes closed to narrow slits, its ears erected, and its body plumage contracted to the tall, narrow, hiding pose assumed by other owls; its colors and its shape make it quite inconspicuous in such a situation. Dr. Errington (1932b) writes: "The trees favored were those to which leaves clung during the winter, those the tops of which were entangled with vines, those with broken, hanging tops, or those otherwise promising sanctuary to owls not desirous of spending the daylight hours in the entertainment of crows."

The behavior of great horned owls in the vicinity of their nests varies greatly with different individuals, though it is generally hostile, especially when there are young in the nest. One pair that I visited twice, while they had young, never showed themselves at all. On other occasions the owls have generally been much in evidence, and more or less threatening in their behavior, flying about near the intruder, alighting in nearby trees, snapping their bills, and hooting. Once I was savagely attacked, while I was climbing to a nest in which the eggs were hatching. I had hardly climbed ten feet on the big pine tree, when the great brown bird glided past me and alighted in a pine beyond. There she sat, glaring at me, swaying from side to side, her wings partly spread, her plumage ruffled out, looking as big as a bushel basket, her ears erect, and snapping her bill furiously, a perfect picture of savage rage. As I continued upward her mate soon joined her, and then followed such a demonstration of angry protest as I had never seen; they flew from tree to tree, dashing past me repeatedly, too near for comfort, snapping their bills, and hooting constantly in deep, subdued tones, *kr-r-r-ooo-ooo, krrooo-ooo.* Only once did they give their regular hooting call.

Once, when I was not looking, I felt the swoop of powerful wings, then a terrific blow on my shoulder, almost knocking me out of the tree, and I could feel the sharp claws strike through my clothes. Several times I had to dodge from the furious attacks. As I neared the nest, I felt a stunning blow behind my ear, which nearly dazed me, and off sailed my hat a hundred feet away; her sharp talons had struck into my scalp, making two ugly wounds, from which the blood flowed freely. This was the limit; I did not care to be scalped, or knocked senseless to the ground, so down I came, leaving the owls the masters of the situation. I visited the nest the next day, with a cameraman to photograph the performance, but the owls failed to repeat their attacks.

I have since learned that my experience was not unique. I find in the literature reports of numerous similar attacks on men at the nests. Professor Keyes (1911) says, of a blow that he received: "It came absolutely unexpected and was so violent as to leave the left side of my head quite numb. * * * The slash which began on the left cheek and ran across the left ear was rather ugly but not dangerous. * * * Three times on this occasion one of the birds flew in from a neighboring tree and with strong stroke of wing came straight at my head. It was not at all the stoop of hawk or falcon, but rather the onrush of a heavy projectile with a very flat trajectory. Like a large projectile too the flight was visible and so all the more disconcerting; unlike a projectile it was noiseless as a flying shadow."

Donald J. Nicholson (1926) received even rougher treatment when he climbed to within 6 feet of a nest containing eggs; he writes: "Swiftly the old bird came straight as an arrow from behind and drove her sharp claws into my side, causing a deep dull pain and unnerving me, and no sooner had she done this than the other attacked from the front and sank his talons deep in my right arm causing blood to flow freely, and a third attack and my shirt sleeve was torn to shreds for they had struck me a third terrible blow on the right arm tearing three long, deep gashes, four inches long; also one claw went through the sinew of my arm, which about paralyzed the entire arm."

Attacks on human beings at other times have been reported several times; a man, moving about at night near the haunts of the owl, is likely to be struck on the head, especially if he is wearing a light-colored cap or one made of fur, which the owl may mistake for some kind of prey. Forbush (1927) tells of one that struck the claws of both feet into the back of a large collie dog. "This bird may have been misled by a white patch on the dog, as the white on the back of a skunk is its favorite mark."

Others have noticed a strange behavior at the nest, which is common with the long-eared owl, but which I have never seen in the great horned. Ralph W. Jackson (1925) describes it as follows:

> As I was climbing the tree to examine the young, which were visible from the ground, I heard short wailing notes to one side and arising apparently from the ground. * * * When about thirty-five feet up, I was surprised to see one of the Owls half running and fluttering some fifty yards away on the floor of the woods with wings outstretched and uttering the notes that I heard a few moments before. Occasionally the bird would stop, beating first one wing and then the

> other, as though wounded. Twice the bird left the ground perching in the tops of nearby trees and then the well known "hoot" was heard, which is the usual form of protestation. In each instance, after a few moments' inspection, the bird returned to the ground and continued the fluttering actions which lasted while I was in the vicinity of the nest.

Dr. Errington (1932a) has noticed similar behavior on three successive years by what he believes to be the same owl.

There is abundant evidence that the eyes of the great horned owl are admirably adapted for effective use in either darkness or bright light. Dr. Elliott Coues (1874) says of his captive owls:

> Their vision was acute at all hours. I often saw them look up and follow with their eyes the motions of a grasshopper or butterfly, flickering several yards up in the air. On one occasion in particular, I saw them both gazing steadfastly, and on looking up to see what had attracted their attention, I was myself blinded by the glare, for the direction was exactly in the sun's eye. But a few moments afterward I discovered a pair of white Cranes, floating in circles half a mile high. The Owl's eyes endured a glare that my own could not, and the birds certainly saw the objects, for they slowly moved the head as the Cranes passed over. * * * Nor was the inner eyelid drawn over the ball to shade it. I had abundant evidence, on this and numerous other occasions, that the movements of the bird's iris are entirely under the control of the will, instead, as commonly supposed, of being automatic, depending upon the stimulus of light. I frequently saw them instantaneously contract or relax the quivering iris in accommodating their vision to different objects, or different distances; and moreover, they could move the two irides independently of each other.

Hearing is exceedingly acute in these and other owls. Mrs. Reed (1925) says of her captive owls: "It was almost impossible to surprise any one of them in the shed although the approach was made as cautiously as possible and from the side where no glimpse of the observer could be obtained. Not only was it possible for them to hear the slightest sound but they could readily localize it. Experiments were made where the observer, concealed, gave various sounds and each time the direction was detected. A tapping on the attic window when one of the captives was perched at the open side of the shed invariably brought a response, the one in question focusing its vision at the origin of the noise."

She seems to agree with Frank Bolles that the sense of smell is not highly developed in these owls; her birds disliked putrid meat but always tasted it before rejecting it. Mr. Shelley, on the other hand, says that he has seen owls caught in traps "where the meat was wholly concealed by refuse and the bird could have been interested only by the musky odor permeating from fresh muskrat carcass."

Great horned owls seldom make satisfactory pets. The one that I raised from a nestling and kept for over two years never became tame; it was always sullen and ugly; it would fly in a rage at any stranger that entered its cage, and often at me. Three of Mrs. Reed's owls made gentle and responsive pets, though no special effort was made to tame them; they would come in response to her call and alight on her arm, even when given full liberty.

But the fourth, in spite of her efforts to tame it, was always "surly, sullen and morose," utterly untameable and vicious. Others have had some failures and some successes. Dr. Errington (1932a) says: "The first two weeks in the young horned owl's life have a singularly profound effect upon its future disposition. Recently hatched owlets accustomed to no source of food other than their human attendants came to recognize them somewhat as they would their own parents, even displaying what appeared a great deal like true affection. On the other hand, an owlet reared by its parents through approximately one-fourth of its growth never did really tame, though it tolerated discreet handling."

Otto Widmann (1907) had a male in captivity that lived for 29 years; but, after he had had a mate for seven years, he killed and partially ate her. Harold M. Holland (1926) tells a remarkable story of a female that was still living after 19 years in captivity; when she was seven years old she laid two eggs; these were removed, and hen's eggs substituted for them, which she incubated and hatched, and afterward brooded the young as if they were her own. "Every year thereafter, in February or the fore part of March, eggs have been laid, the clutch never exceeding two, although sufficient time for a third was allowed, and as often has followed the substitution of hen's eggs. And each returning spring has witnessed the bringing forth and mothering of young by this faithful bird."

Voice.—The hooting of the great horned owl is, according to my experience, entirely different from the vehement, strongly accented, and spectacular hooting of the barred owl. It is on a lower key, deeper bass, and softer, but it has great carrying power. I have likened it in my notes to the sound of a distant foghorn, the far-away whistle of a locomotive, or the barking of a large dog in the distance. At times, when near, it has seemed more like the cooing of a dove than the hooting of an owl. The ordinary note, when the owl is not excited, is a prolonged, soft, somewhat tremulous, and subdued hoot, with little or no accent, *whoo-hoo-ho-o-o*, or, longer, *who-ho-o-o, whoo-hoo-o-o, whoo.* A still softer, cooing note sounds like *hoo-ooo-ooo-ooo.*

Once, when the owls were somewhat excited and young birds were in the nest, the hoot was preceeded by a short bark, *wa'-hooo-oo-oo-oo*, but the bark was not so strongly accented as that of the barred owl. Again, when the owls were greatly excited, I recorded a more strongly accented hooting, *whoo'-hu-hoo', hu-hoo'-hoo', whooo*, or, shorter, *hu-hu-hoo-hóoo*; the short notes were rapidly given, and the whole was in the usual soft tone. While the owls were attacking me, referred to above, they uttered angry, growling notes, which I recorded as *krrrooo-ooo*, but I have never heard the blood-curdling screams that others have described. There is a sexual difference in the notes, the voice of the supposed male being pitched on a lower key, perhaps three or even four half-tones lower; his notes are more prolonged and elaborate, rich, deep, and mellow; hers are usually shorter, simpler, and softer.

I once watched a female hooting at short range, while I was at the nest. She was perched on a tree within ten yards of me, bristling up her plumage, with half open wings, snapping her beak, and hooting softly. She generally leaned forward in a nearly horizontal position while hooting, and I could plainly see the vibration of her white throat. Once she became more excited and gave a louder, more vehement laughing note, *wha, whaart.*

Mr. Shelley writes to me of an unusual demonstration that he heard one night, while he was out coon hunting: "There were three birds at least, and their increased hooting and following display may have been occasioned some by our flashlights, as we approached and attempted to spot the birds themselves. Anyhow, their ordinary hooting was changed to weird, hollow-toned, and idiotic laughter. They flapped from tree to tree with much noise and gave a chuckling noise meanwhile. There were variations in the hooting: *Whoo-who-who-whoo-who-who-oo-oo,* one would call; and another, *whar, who, whar, oo-who-o-o-o-ooh,* ending in a throaty chuckle. And they would make a great din flapping their wings. One particular bird liked best its eerie and idiotic laughing call, depicted by the following phrasing: *Whar, whah, wha-a-a-a-ah,* the accent on the last syllable of each *whah;* it had a carrying quality similar to the water-pumping note of the bittern."

Mr. Norton (1928) heard a variety of other notes from the female of the pair he was watching, such as "*ank*?; *ank*?; *ank*?; in a key higher than her usual one. * * * Sometimes she called in a hawk-like note, *ke-yah, ke-yah.* * * * The female called twice from the nest, in feeble tones, *erk, erk.* * * * From the direction of the nest a *meow* like that of a cat was heard."

Many other observers have given somewhat similar renderings of what were probably the same notes that I have attempted to describe above. But I suspect that some unusual notes, ascribed to this owl, have been those of the barred owl, wrongly identified. Clarence F. Stone tells me that the loud, harsh, blood-curdling screams referred to above are the food calls of the yearling young, heard through the first summer and fall, and are not uttered by adults.

William Brewster (1936) says of a young owl that he had in captivity: "At intervals of from one to five minutes during the night and occasionally by day, as well, it uttered a short, harsh, penetrating cry which was not unlike the peep of *Chordeiles* and which, no doubt, was merely a variation—perhaps characteristic of very young birds—of the Jay-like cry that I hear every autumn at Lake Umbagog. I suspect that by means of this call it finally attracted the attention of one of its parents."

Field marks.—The great horned owl is the largest of the common resident owls of the United States, somewhat larger than the barred owl, darker in color and brown rather than gray; some of the paler races are quite light colored, but they are found in regions where the barred owl does not occur; they are paler than the spotted owl but considerably larger. In all the races the wings seem very long and broad in flight, and the ear tufts are very prominent when the owl is perched. At short range the white throat patch is conspicuous and the large yellow eyes may be seen. In flight the ear tufts are flattened and do not show, but the large head and short neck are distinctive.

Enemies.—Horned owls have plenty of enemies that cordially hate them, but none of them are dangerous, except man and occasionally one of their own species. Crows are their chief enemies, with blue jays a close second and all other small birds following. I have often been able to locate an owl by the clamor of a noisy and excited mob of crows. If an owl is discovered by a crow, the alarm is immediately given and all the crows within hearing respond to the call, gather about the owl, flying around or perching in the tree as near to the owl as they dare go, cawing loudly and making a great fuss. They seldom are bold enough to strike the owl, though I have seen them do so twice. The owl stands all this with dignified indifference, until his patience is exhausted, when he flies away with a string of crows trailing on behind; perhaps he has to move several times before he shakes off his tormentors or finds a secluded hiding place, where he can doze in peace. The owl seldom retaliates by striking one of the black rascals; in fact, I doubt if he ever does. But he gets even with them when they are in their roosts at night; I have heard of several crow roosts that were broken up by a great horned owl living in the vicinity; and many an owl has eaten crow.

Horned owls are sometimes attacked by the larger hawks in contests over nests, but the owl usually wins. On a Louisiana highway that had been open only a few weeks, William B. Ward (1934) found, on a 10-mile stretch of road through a swamp, 17 large owls that had evidently been killed by automobiles.

Winter.—Horned owls are often said to be permanently resident throughout their ranges, but this is true only in the more temperate regions. When the snow is deep and game is scarce in Canada, we may look for heavy flights of northern owls to more congenial winter hunting grounds. Arthur W. Brockway (1918) reported a heavy flight at Hadlyme, Conn., in November and December 1917; a game keeper there trapped 91 great horned owls during the fall and winter.

Referring to the same flight, J. Dewey Soper (1918) says: "The point of interest lies in the fact that the Horned Owls were apparently absent from the north country at the time of my trip October 20–November 6; common on my return to Preston, Ont., November 7, and apparently so at other points in southern Canada." Mr. Forbush (1927) mentions other similar flights. He says also: "Mr. H. A. P. Smith writing from Digby, Nova Scotia, March 14, 1923, says that a Great Horned Owl was found there sitting upright in an apple tree frozen stiff. Probably his tightly clinched talons froze to the limb and held him there in death; but the bird would not have been frozen had it had food enough to keep up the animal heat in its body."

Dr. Errington (1932a) writes:

> Prior to 1932, it was noted casually that horned owls were apt to station themselves in the fall in the near neighborhood of old stick nests (hawk or crow) which they would appropriate in the spring. During the season of 1931–1932 this was checked up more carefully. In the late fall, 1931, five horned owl territories were discovered in regular use (judged by birds seen and by accumulations of feces and pellets beneath roost trees), of which four proved to be nesting areas.
>
> Three other nesting areas, not actually visited in the fall, betrayed by old pellets their early occupancy. Exception: one pair did not move into their nesting territory until January or later, though breeding was not delayed, as incubation had started by February 21, 1932.

DISTRIBUTION

Range.—The greater part of the Western Hemisphere except only the islands of the Caribbean and the Arctic Archipelago. Nonmigratory.

The range of the horned owl extends **north** to Alaska (Allakaket, Wiseman, and Fort Yukon); Mackenzie (Fort McPherson, Fort Good Hope, probably Sarahk Lake, and Stone Island in Great Slave Lake); Manitoba (Fort Churchill and York Factory); Ungava (Fort Chimo); and Labrador (Okak). **East** to Labrador (Okak, Turnivik Island, Hopedale, and Rigolet); Quebec (Sandwich Bay, Muddy Bay, and Lance au Loup); Newfoundland (Raleigh and Glenwood); Nova Scotia (Pictou and Halifax); Maine (Calais, Bangor, and Auburn); Massachusetts (Danvers, Boston, Plymouth, and Woods Hole); Long Island, N. Y. (East Patchogue); New Jersey (Princeton and Sea Isle City); Virginia (Spottsville and Dismal Swamp); North Carolina (probably Arcola, Raleigh, and probably Cape Fear); South Carolina (Waverly Mills, Mount Pleasant, and Frogmore); Georgia (Savannah, Blackbeard Island, and probably Okefinokee Swamp); Florida (St. Augustine, San Mateo, New Smyrna, Merritt Island, probably Sebastian, probably Bassinger, Fort Lauderdale, and Westlake); Tamaulipas (Soto La Marina); Puebla (Orizaba); Yucatan (Chichen-Itza); Brazil (Matto Grosso and Agua Blanco de Corumba); Paraguay (Fort Wheeler); Argentina (Upper Rio Chico, Patagonia); and Chile (Gregory Bay, Straits of Magellan). **South** to southern Chile (Gregory Bay, Straits of Magellan). **West** to Chile (Gregory Bay, Straits of Magellan, and Santiago); Ecuador (Cechce, Mount Chimborazo, Bestion, and Upper Antisana); Costa Rica (San Jose and Chitra); Nicaragua (Matagalpa); Honduras (Tegucigalpa); Guatemala (San Lucas and Panajachel); Oaxaca (Tehuantepec and Cacoprieto); Michoacan (Querendaro and Zamora); Jalisco (La Barca, Guadalajara, and Etzatlan); Baja California (Cape San Lucas, La Paz, Sierra de la Victoria, Magdalena Bay, probably San Fernando, Rosario, San Pedro Martir Mountains, and Gardiners Lagoon); California (San Diego, San Onofre, Los Angeles, Santa Barbara, Monterey, Santa Cruz, Micasio, probably Camp Meeker, probably Cahto, and Crescent City); Oregon (Gold Beach, Elkton, Newport, Netarts, and Olney); Washington (Grays Harbor, Lake Crescent, probably Mount Vernon, and Bellingham); British Columbia (probably Errington, Beaver Creek, Lund, and Hazelton); and Alaska (probably Forrester Island, Rodman Bay, Yakutat Bay, Hawkins Island, probably Iliamna, Chulitna River, Wood River, Bethel, Marshall, Nulato, and Allakaket).

The vast territory covered by the above outline is for the entire species, which has, however, been separated into a large number of subspecies or geographic races. In the revision of the American great horned owls by Oberholser in 1904, no less than 11 forms were recognized for the North American Continent, including Baja California, with five others occupying ranges in Central and South America. Ridgway, who examined the same material, recognized the same races in his work on the birds of North and Middle America in 1914. The 1931 A. O. U. Check-List recognizes 10 of the 11 of Oberholser and Ridgway (considering *B. v. wapacuthu* as a synonym of *B. v. subarcticus*), rejecting only *Bubo virginianus icelus*, which in the opinion of some systematists is an entirely valid form. Still other races are accorded recognition by other systematic ornithologists, from which it will be seen that the last word on the subject has not yet been said. Accordingly, and probable errors admitted, it seems desirable for the purposes of this report to adhere to the latest official pronouncement of the American Ornithologists' Union and to follow, in general, the 1931 Check-List.

The typical great horned owl (*B. v. virginianus*) is found in eastern North America from Ontario, Quebec, and New Brunswick south to Florida and the Gulf coast and west to Wisconsin, eastern Minnesota, southeastern South Dakota, eastern Kansas, Oklahoma, and eastern Texas.

The Labrador horned owl (*B. v. heterocnemis*) ranges from the northern part of the Labrador Peninsula and Newfoundland south usually to Connecticut.

The Arctic horned owl (*B. v. subarcticus*) (=*B. v. wapacuthu* (Gmelin) of Oberholser and Ridgway) is found from the limit of timber in the Mackenzie Valley and Hudson Bay south to northern Alberta, northern Saskatchewan, central Manitoba, and northern Ontario. In winter sometimes reaching southern British Columbia, Idaho, Nebraska, and Wisconsin. Casual in New York and Massachusetts.

The western horned owl (*B. v. pallescens*) ranges from northeastern California (Lassen County), Idaho, and Utah east to New Mexico and central Texas and south to the Mojave Desert and the Mexican States of Sonora, Durango, and Nuevo Leon.

The dwarf horned owl (*B. v. elachistus*) occurs chiefly in the Cape district of Baja California.

The Pacific horned owl (*B. v. pacificus*) occupies the great interior valleys of California south to northern Baja California.

The Montana horned owl (*B. v. occidentalis*) occurs from southeastern Oregon, central Alberta, Montana, South Dakota, and Minnesota south to Iowa, Kansas, Wyoming, and northeastern California.

The northwestern horned owl (*B. v. lagophonus*) ranges from Cook Inlet and the interior of Alaska south through central and eastern British Columbia to northeastern Oregon and Idaho. Casual in Colorado and Minnesota.

The dusky horned owl (*B. v. saturatus*) is found from the coast region of southeastern Alaska south to northern California.

The St. Michael horned owl (*B. v. algistus*) occupies the coastal regions of Alaska from Bristol Bay north to Kotzebue Sound and casually Point Barrow.

Migration.—As stated above, the horned owls are nonmigratory in the sense that they do not make regular seasonal journeys between breeding and wintering grounds. That they can perform flights of considerable length is demonstrated by the casual records of specimens of certain geographic races that have been collected at points well outside their normal ranges. Such travels are, however, probably caused by shortage of the food supply in the normal range of the individual concerned rather than by the seasonal prompting that is responsible for the journeys of the truly migratory species.

This is further exemplified by a study of banding data. The files of the Biological Survey contain the recovery records of more than 40 banded horned owls. With few exceptions these birds were all recaptured within a relatively short distance of the place where they were banded, the elapsed time being from a few months to about two years. In only one instance is there definite evidence of a long flight—a juvenile bird banded at Rosebud, Alberta, on May 23, 1930, and recovered at Antelope, Mont., on January 8, 1931. The distance covered is about 220 miles.

Egg dates.—Alaska and Mackenzie: 5 records, April 1 to May 13.

Labrador and Newfoundland: 4 records, April 3 to May 2.

Alberta: 26 records, February 23 to May 29; 13 records, March 15 to April 5, indicating the height of the season.

New York and New England: 66 records, January 18 to May 8; 33 records, February 28 to March 21.

Pennsylvania and New Jersey: 30 records, January 21 to May 2; 15 records, February 23 to March 5.

Florida: 9 records, December 7 to March 30.

Ohio to Iowa: 21 records, February 1 to May 28; 11 records, February 8 to March 9.

British Columbia to Oregon: 9 records, March 2 to April 23.

California: 106 records, January 29 to April 17; 53 records, February 25 to March 23.

Lower California: 3 records, January 31, February 2, and April 19.

Arizona and New Mexico: 9 records, February 28 to May 3.

Texas: 48 records, January 12 to June 12; 24 records, February 12 to March 12.

BUBO VIRGINIANUS PALLESCENS Stone

WESTERN HORNED OWL

Plate 76

HABITS

Contributed by Milton Philo Skinner

While there is a general resemblance between the eastern horned owl and the western forms, there are some differences. Most characteristic, in the old days, was the preference of the westerners for rodents, rather than for birds. Perhaps this was due to the comparative wildness of the West, as well as to favorable habitat, which permitted the many kinds of small rodents to exist in astonishing numbers. Now that the rodents are everywhere disappearing, the big owls may turn to birds as they have done in the East. But the western horned owls, in common with other raptors, are now, themselves, the objects of a pitiless persecution and destruction that is sadly decreasing their numbers.

Spring.—It is not certain that there is any real migration of horned owls in any part of the Western United States, although at times, under stress of cold or hunger, Canadian birds may come south in great numbers.

Courtship.—So little is really known of the courtship of these big birds that it is a distinct pleasure to read Chief Red Eagle (1929). He says:

> It was well after sundown one evening in the early part of the past winter. * * * I was quietly picking my way eastward along the rocky bed of a rather deep and narrow canyon at the southern edge of the Capitan Mountains of New

Mexico, * * * when I heard the weird, thrilling *whoo-whoo-whhuu* of an owl ahead of me.

I peered from a clump of low juniper bushes and saw, about 20 yards to the west, the tall, nearly branchless trunk of a dead yellow pine, its upper part sharply outlined against the cold, clear, roseate sunset sky beyond. And there, perched side by side on a stub of a branch jutting out to the north, way up near the top, I beheld two very large and magnificent Western Horned Owls.

In a moment one of the pair suddenly tipped head downward on the branch until his beak was a bit lower than the level of his feet, dropped his wings, thrust up his short tail, and fluffed his soft feathers, making him appear even larger than he was, and at the same time poured out a long-drawn, haunting, thrilling, quavering *hoo-hoo-whooho-uhuhuuu-whhhhuuu.* As the call ended he (or she) at once popped back into upright position on the stub again.

Immediately, the other Owl fluffed its feathers and tipped forward and downward and hooted as had its mate, though I could easily detect quite a difference in the calls. It swung back upright again, and I could plainly see one and then the other snap its curved beak sharply and could hear the clicking of them on the crisp air.

Then, as if by some sign, they simultaneously turned their broad 'faces' to each other and began rubbing their beaks together, for all the world as if they were kissing and making love, much after the fashion of Pigeons and Doves. A few seconds of this, and they both swung down on the stub at the same time and hooted their eerie calls again. Then they straightened up and billed some more.

For several minutes they kept up this unusual performance, alternately hooting and billing, sometimes one hooting at a time, sometimes both at once, and always there was the snapping of their beaks mixed in.

Once a prowling coyote made a slight rustling in the sere oak leaves as he slipped through the brush in a small ravine several yards to the rear of them. * * * I could tell by their actions that they had discovered the animal at once, but the pair seemed to realize that a coyote could not climb trees, * * * and in a few moments the two settled back to their courting once more, evidently no longer concerned about the animal.

I watched there till the shadows in the canyons and thickets grew black and mysterious and night had settled in earnest. Then, after a bit, I tried a new tactic. I hooted, quavering, long-drawn-out, as nearly as I could imitate their weird calls. They did not seem alarmed, but were immediately attentive to the sound. First one, then the other, would answer me, but they ceased their billing and love-making.

Nesting.—The western horned owl makes her nest early in the year in a small cave, or on a ledge, or a cliff; in a hollow tree; or on an old crow, raven, or hawk nest. Under primitive conditions, there were so many owls in comparison with the available sites that some were no doubt forced to utilize whatever places might be vacant, making it difficult for us to determine if there ever was any real preference; and if so, for what.

Bendire (1892) says: "In the neighborhood of Nueces Bay, in southwestern Texas, they nest in holes in high banks." Lacey (1911) writes that in other parts of Texas these owls nest in caves in bluffs and on the tops of squirrel nests in trees. Carroll (1900) says that they adopt "the nests of Buteos and Caracaras. Breeding begins in January. Have found their nests far out in the prairie in small mottes, miles from timber." W. B. Savary writes us: "On the south side of the Aransas River in Bee County, about 12 miles from Skidmore, I found a western horned owl and a turkey vulture nesting in a large live oak, each in a separate cavity. The vulture had the lower and larger one, which was nearly 3 feet in depth and 18 inches in diameter. The young vulture was standing up and probably 10 or 12 days old. The owl's nest was in a smaller cavity where a hollow limb had broken off on the opposite side, about 4 feet higher up. The young owlet was in the down with quills showing; very likely it was two weeks old."

In New Mexico, Jensen (1923) says: "A pair is nesting regularly in a cut on the Santa Fe–Lamy Railway near Arroyo Hondo. The incubating bird is only about six feet from the passing trains." In Arizona, Kennard (1923) found a western red-tailed hawk's nest about 15 feet above the ground in a mesquite tree. It "was found to contain three Hawk's eggs and one of an Owl, presumably a Western Horned Owl * * *. Of the Hawk's eggs, one had been dented on some previous occasion, presumably by the claw of the parent bird, and was addled, and the other two were pretty hard set; while the Owl's egg was much fresher, laid I should say at least a week after those of the Hawk." Although most observers say there is little or no actual building of a nest, Mrs. Bailey (1928) says that they "are variously lined with sticks, leaves, bark, moss, and their own feathers." In Arizona, these owls often nest in the great hollow arms of the saguaro, the giant cactus, and still oftener in the deep crotches between those arms. Nests may be at a considerable height in a tall cottonwood; but when placed on old magpie nests, or in stunted cedars and junipers, they may be as low as only 10 feet above ground.

Strange to say, some of these owls nest in old Indian or cliff dwellings. Sugden (1928) says:

> The nest was in a cliff dwelling about a mile above the Augusta Natural Bridge in White Canyon, San Juan County, Utah. This Moki cliff dwelling, the habitation of a prehistoric Indian, was in a ledge in the sandstone wall of the canyon about 20 feet above the dry stream bed. It consisted of two rooms, the larger about 8 feet square, the smaller about 6 by 8 feet. The nest was in the far corner of the smaller room, on the side next to the cliff wall. The roof had fallen in on the outer side but was supported on the inner side, forming a shelter over the nest. On the floor of the dwelling was a thick layer of pack-rat droppings and debris including the cactus spines remaining after the rats had eaten the fleshy parts. The nest itself was a depression in the debris lined with a few sticks, bones, feathers and excrement.

Of a somewhat similar location, Gilman (1909) writes: "For at least four years a pair of these owls have nested in the pre-historic Casa Grande ruins. * * * Mr. Pinkley [the custodian] told me the birds raised a brood each year in the old building, and had never been molested except once, when one of them developed a decided taste for prize Wyandot chickens."

The actions of the old birds vary a good deal when their nests are molested or robbed. Usually they show extreme anger and recklessness, diving again and again at the intruder and keeping up a constant cackling, or snapping of their bills. On the other hand, they sometimes make no disturbance whatever. At one nest visited by Gilman, he (1909) says that the old birds "made no demonstration when I climbed to the home. A Redtail that percht in the top of a neighboring tree did not escape so easily tho, as the male owl savagely attackt him, and drove him off." Apparently the female does all the incubating, although the male is often in the vicinity, and is generally ready to do his share toward defense of nest or young.

Eggs.—Usually there are two eggs to a set, sometimes three. Fresh eggs are to be expected in the southern sections of Texas and Arizona, and presumably New Mexico, in February, but later farther north; for instance, near Santa Fe, "March 10 to April 10," according to Jensen (1923). The measurements of 47 eggs average 54.7 by 46.5 millimeters; the eggs showing the four extremes measure **59.2** by 48.3, 56 by **49**, **51.8** by 46.3, and 54.1 by **44** millimeters.

Young.—Since there has been some confusion between the reports for this species and for the Montana horned owl, much that is said under that subspecies, particularly about "Nesting", "Eggs", and "Young", applies nearly as well to *pallescens.*

After the eggs have been incubated about 28 or 29 days, the young hatch out as downy, yellowish-white balls. They are very weak and unable at first even to stand erect; but their legs and feet, being quite strong, enable them to retain a firm grip of the sticks and other foundations of their home. There is usually a very noticeable variation in size among the two or three owlets of a brood, due to the eggs being laid as much as two or three days apart. As incubation begins as soon as the first egg is deposited, the eggs may hatch several days apart. At first the young birds take little notice of any intruding person, but grow shier as they grow older and then resent intrusion to the best of their ability, hissing and shrinking away as far as the limits of the nest will allow.

Plumages.—At first the down does not entirely cover the little owls, patches of bare skin showing here and there. But as the down grows longer and spreads out more and more, the bare patches diminish in size. The succeeding plumage is much darker but is more uniform in color and the markings less sharply defined than the third, or adult, plumage that appears later.

Food.—While this owl usually remains hidden during the day and does most of its hunting at night, it can see well enough to do some by day, if necessary. Henshaw (1875) was inclined to believe that it hunted more by day while it had young.

Under a nest at the western base of the Davis Mountains, Tex., Vernon Bailey (1905) found remains that indicated the food of the young during the summer of 1902. The most abundant remains were bones of cottontails and half-grown jack rabbits. There were also skulls and other bones of pocket gophers, two species of wood rats, a large kangaroo rat, two species of pocket mice, white-footed mice, grasshopper mice, spotted skunks, and bats. "Bones of horned toads and snakes were common and the legs and shells of beetles, grasshoppers, and various insects were abundant in the mass. I found one sternum of a bird the size of a meadowlark and one lower mandible that was probably from a chicken." There was a ranch near this nest but Mr. Bailey says: "The ranchman admitted that only one or two chickens had disappeared during the summer, but even then he could not get over the idea that owls lived on chickens and were his enemies." While reading over this list we should remember that perhaps pellets and discards from the nest may not always show the full proportion of birds consumed (see Brooks, 1929). Along the Mojave River, near Victorville, Calif., these owls seem to live largely on meadow mice.

Although it seems so strange that owls should eat skunks, this subspecies has the habit fully developed. Huey (1931) says: "One of these birds was collected in December, 1915, at Fort Lowell, near Tucson, Arizona, and had a discolored area on its plumage where the scent had struck, which was, however, of a light pinkish color, not yellow. As there are three genera of skunks (*Conepatus*, *Mephitis*, and *Spilogale*) to be found in or near the locality where this owl was secured, we may perhaps assume that one of the two larger forms, not *Spilogale*, had been the victim of the owl. * * * The other Horned Owl was taken in January, 1917, at Potholes, Imperial County, California, and was marked with a yellow stain." Probably this owl had been preying upon a *Spilogale*.

A. B. Howell (1916) writes: "I had always understood that an owl is in the habit of killing its prey by a single bite through the head or neck, and, indeed, I have had indubitable evidence that such is often the case. However, on the first of the year, I flushed an owl from the ground, and discovered that it had abandoned a freshly-killed cottontail." But there were no marks on it except a few claw punctures on the trunk of the animal.

Mrs. Bailey (1928) adds ground squirrels, prairie dogs, fish, crawfish, scorpions, cattle grubs, Jerusalem crickets, moths, and vinegarroons to the prey already given. Western horned owls being large, voracious birds, they sometimes kill game birds and poultry. Lacey (1911) says: "Small rabbits seem to be their principal food, but occasionally they harry the hen roosts and I have known them to kill young wild turkeys, even when half grown." E. R. Warren writes us that although cottontails were the main food at one nest, he also found magpie feathers scattered about, and adds that there was a magpie's nest in the tree below which they were found.

With its great killing powers and its boldness, the potential capacity of this species for harm is very great, especially where poultry is allowed to remain out in trees all night. Fisher (1907) says of the horned owl that if it could be "considered only as it appears in the great West, it would earn a secure place among the beneficial species. * * * Where mammals are plenty it does not seem to attack poultry or game birds to any considerable extent, but in regions where rabbits and squirrels are scarce it frequently makes inroads on fowls, especially where they roost in trees. Undoubtedly rabbits are its favorite food, though in some places the common rat is killed in great numbers; we have a record of the remains of over one hundred rats that were found under one nest." Quite often small birds seem indifferent to the presence of a horned owl. E. R. Warren writes us, in a copy of his notes, of an owl in a cottonwood tree. "At the same time a pair of Rocky Mountain nuthatches were climbing about in the tree and not far from the owl and not paying the slightest attention to it. In another tree close by violet-green swallows were going to and from their nest hole, probably feeding young."

Behavior.—Before the Western States were settled as thickly as they are now, these owls appear to have been quite abundant, particularly where there were thick groves or large trees to shelter and hide them during the day. But they did, and do even now, sometimes take shelter in dark caverns in more or less perpendicular cliffs. After remaining quiet in some such secure retreat all day, they come out usually about sunset, although they vary in this somewhat. Probably all remain well below 8,000 feet throughout the breeding season, and some then travel up as high as 11,000 feet above sea level, only to descend again before cold weather. Of the very lowest parts of their habitat along the Gila and Colorado Rivers, Gilman (1909) says they are "found mostly in cottonwood trees, * * * and at night range out on the alfalfa fields in search of gophers. I have seen them also in bluffs and cliffs on the rocky hills a few miles from the river. * * * A favorite perch of the bird is the roof of a building, and there they sit and murder sleep in the most approved fashion, along about 2 a. m. I have been obliged to get up repeatedly and go out and throw rocks at them in order to get my normal amount of slumber."

Although I have no notes on the bathing of these birds, they are known to visit springs and pools at night to drink; and they may bathe there then, too.

Voice.—The characteristic solemn, deep-toned hooting of the western horned owl is very much like that of the eastern subspecies. Usually it is sounded in the evening and early in the morning but sometimes during the daylight hours as well. Whenever a nest is disturbed, both owners are apt to voice their protests in a series of *hoo, hoo, hoo-oo's* from some nearby tree or other elevated perch.

Enemies.—I have often been directed toward one of these owls by the long-crested jays, the hubbub raised by a mob of these smaller birds being almost unbelievable. Although this sport seems safe enough in daylight, I have no doubt that the owls can, and do, capture many a daytime tormentor at night. But why should these tormenting jays be safe during the day? The owls are able to see, and there appears to be no real reason why they could not turn the tables then as well as after dark.

Winter.—Howell (1916) says for Tucson, Arizona: "I am sure that the residents [owls] of the region must be augmented during the cold weather by numbers which have come down from the mountains. L. S. Wylie, on the boundary of whose chicken ranch we camped, * * * is much bothered by these owls. He states that one will alight on a branch where a chicken is roosting. The latter will awaken and shriek, but is too scared to move. The owl then sidles along and grabs the fowl by the neck." Possibly the killing of chickens, and also of game birds, may be greater during winter, when so many rodents are either under the snow or hibernating.

BUBO VIRGINIANUS SUBARCTICUS Hoy

ARCTIC HORNED OWL

HABITS

A very pale race of the horned owl, sometimes almost as white as some snowy owls, inhabits the more northern timbered regions of Canada, as far south as central Alberta, Saskatchewan, and Manitoba, where it intergrades with *occidentalis.* Breeding birds that we collected in southwestern Saskatchewan were intermediate. All three of the adults we collected are very light colored, particularly above, where they are fully as light as the average and almost as light as the lightest *subarcticus.* On the under parts, however, there is more ochraceous and less pure white than there should be. The legs and feet are somewhat clouded with pale ochraceous, and the legs are faintly barred with dusky. In typical *subarcticus* the legs and feet should be pure white.

Nesting.—The only nest I have ever found that might possibly be referable to this race was discovered near Crane Lake, Saskatchewan, on June 5, 1905, from which one of the adults, referred to above, and one of the young were collected. We were exploring a breeding rookery of great blue herons in the timber along Skull Creek, when we discovered that a pair of these owls had taken possession of an old heron's nest. It was a very large nest, measuring 3 feet in diameter and placed 20 feet from the ground in the dead top of a large cottonwood tree; it was well decorated with down and littered with feathers and bones of the owl's victims. There was an occupied heron's nest in the next tree, about 15 feet distant. The single young owl had left the nest and was clinging helplessly in the top of a small sapling nearby; it was nearly fully grown but still unable to fly. We did not see the old owl at first, but I soon saw her coming across an open space, heading straight for me at full speed, as if she intended to knock me over, but she swerved to one side and passed me.

Frank L. Farley writes to me: "Two nests that I have examined belonging to the Arctic horned owl were both located in heavy timber on the south side of Dried Meat Lake. One of these, found on March 17, 1934, contained three fresh eggs. It was built in the crotch of a very large cottonwood tree, about 60 feet from the ground."

A set of three eggs in my collection was taken by A. D. Henderson near Belvedere, Alberta, on March 20, 1924, from an old hawk's nest in the upright forks of a balsam poplar, at the edge of a small spruce muskeg. It was about 45 feet from the ground; a few fresh twigs had been placed around the edge by the owls, and feathers from the sitting bird had been added. It had snow on it around the edges. This nest was about 400 yards distant from another nest robbed the same day.

Referring to these and other nests, Mr. Henderson (1925) writes: "From this date forward we were out almost daily and including the nests containing young found seventeen nests of the Arctic Horned Owl. Of many nests of the birds found in the vicinity of Belvedere, only five were in spruce trees and one in a tamarac. The usual location is in an old nest of the Western Red-tailed Hawk, in aspen or balsam poplar trees. Occasionally an old nest of the Crow is used."

Writing of his work near Fort Simpson, Edward A. Preble (1908) says: "On March 14 I saw a pair in the vicinity of a prospective nest in a high Banksian pine on the hills southwest of the post. The place was again visited April 1 and the female found on the nest. It was left for future developments, but later in the day the tree was cut down by an Indian, and the nest and contents, two fresh eggs, destroyed. On April 17 I found another nest near the banks of the Liard, a few miles distant from the post. It was in the crotch of a large aspen poplar, 50 feet from the ground, and held a single egg. It was visited again on April 22, and the two eggs and the male bird secured."

Eggs.—Mr. Henderson (1925) says: "The usual number of eggs laid is three, but clutches of two and four are also quite common, and

I once found a nest containing five." The eggs are just like those of other horned owls. The measurement of 50 eggs average 55 by 45.9 millimeters; the eggs showing the four extremes measure **58.9** by **50.8,** **50.1** by 45, and 52.6 by **41.2** millimeters.

Food.—Mr. Henderson (1925) says: "Their principal food in this section is the varying hare and they are much more plentiful at the periodical times of abundance of these animals." Mr. Farley tells me that "remains of Hungarian partridges have been found in pellets picked up near their nests." Mr. Preble (1908) writes: "One taken November 21 had eaten a small shrew (*Sorex personatus*); one November 23, a red squirrel (*Sciurus hudsonicus*); one December 1, several meadow voles (*Microtus drummondi*), white-footed mice (*Peromyscus arcticus*), shrews (*Sorex personatus*)." He also mentions three that had eaten several large water beetles (*Dytiscus dauricus*).

This owl seems to be almost wholly beneficial in the regions that it lives.

Its plumage changes, behavior, and voice do not seem to differ materially from those of other horned owls. It is more migratory than the other races, as it is difficult for it to find sufficient food in its far northern home in winter. In the big flights of northern owls that drift into New England and other northern States during certain winters, specimens of very pale birds are occasionally found that are referable to this subspecies. Mr. Farley says in his notes: "The Arctic horned owl is a fairly regular winter visitor to central Alberta. In lesser numbers it is a resident throughout the year. The migrants from the north and west make their appearance in September and October and remain until February."

BUBO VIRGINIANUS SATURATUS Ridgway

DUSKY HORNED OWL

HABITS

Contributed by Milton Philo Skinner

This subspecies, living as it does in the dark, humid coast forests of northern California, Oregon, Washington, British Columbia, and Alaska, is the darkest of the horned owls. But its habits and ways of life closely resemble those of other western forms.

Nesting.—In California these owls are apt to have their homes in the tops of oaks, in canyons, as a rule 30 to 50 feet above ground. Sometimes they nest in firs, and the nests are usually made of coarse sticks. Whether this subspecies ever builds its own nest is not known; but it is known to adopt old hawk nests, just as members of other subspecies do.

Eggs.—[Author's note: The eggs of the dusky horned owl are like those of the other horned owls of similar size. Apparently, from the data at hand, sets of three are commoner than sets of four. The measurements of 26 eggs average 55.1 by 46; the eggs showing the four extremes measure **60** by **47.7**, **52.7** by 43.4, and 53.1 by **42.4** millimeters.]

Young.—Owlets are usually hatched out in March after an incubation of approximately 28 days. About two months later they leave the nest and are then taught to hunt by the parents.

Plumages.—The development of their plumage is much like that of the Montana horned owl. Perhaps the coloration of adults of this form shows more variation than other subspecies ordinarily do. Perhaps because the dusky horned owls live in a rainy, cold forest, their plumage is thicker and heavier. Bowles (1918) says: "One markedly noticeable feature * * * is the great luxuriance of feathers. In the made-up skin this is seen to best advantage about the legs and feet, where the hair-like feathers closely resemble a long and heavy coat of fur. Looking over my series of these owls taken in the past few years I can find none that are nearly as well feathered as those of the present season. This may, perhaps, suggest a very severe winter, but up to date it has been about the mildest that I have ever seen here." (December 17, 1917.)

Food.—Although it is known that the dusky horned owls devour great numbers of mice, house rats, various species of squirrels, and skunks, their life in the dense, giant tree forests gives them added opportunities to destroy birds. Perhaps this tendency has been too greatly commented upon, most of the notes we have being from game wardens and others antagonistic to the Raptores. Bowles (1916) speaks of the dusky horned owls as preying upon wood ducks and mallards and says he "has found the remains of Sooty Grouse, Oregon Ruffed Grouse, Ring-necked Pheasants, and Steller's Jays" at the base of a nesting tree after the young owls have left. As for myself, I have noted more of a tendency to hide uneaten prey and return to it again later. As this return is not invariable, it might be more accurate to say that the dusky horned owl often returns to uneaten prey if it has not been able to make a fresh kill. At times, I have found this subspecies hunting in couples. Racey (1926) reveals something of the boldness and ferocity of this owl when he writes: "One evening when my family was returning to camp at dusk, one of these Owls flew down and tried to seize our small Pekinese dog and when driven off flew only a short distance away and perched on the limb of a dead tree."

Behavior.—Aside from living in the humid Pacific coast zone, the dusky horned owls differ little in behavior from the western subspecies described elsewhere. They may, perhaps, be a little more given to daylight movements than others, owing to the natural darkness of their chosen habitat.

Voice.—The hooting call of the dusky horned owl is similar to that of other subspecies. Mailliard (1924) says of owls in Sonoma County, Calif.: "These birds have a much larger vocabulary of notes and combinations of notes than is commonly supposed. The whistling note, with rising inflection, that is used in communications between the parents and the young, when the latter are first flying about, is often repeated for hours at a time during the night, or even in the daytime when the young happen to be in a nearby tree and no strangers are in the vicinity."

Blackwelder (1919) says that "the call of the male is shorter and of lower pitch than that of the female."

Bowles (1906b) adds the seemingly strange observations, that although these owls are common in fall and winter, he has never heard them utter a note. But this is in direct contrast with Dawson (1923) who says:

> As a young man, in Tacoma, the writer once lived in a house which immediately adjoined a large wooden church. My chamber window looked upon a flat kitchen roof, through which projected a brick chimney some ten feet away. At three o'clock one morning a horrible nightmare gave way to a still more horrible waking. Murder most foul was being committed on the roof just outside the open window, and the shrieks of the victims (at least seven of them!) were drowned by the imprecations of the attacking party—fire-eating pirates to the number of a dozen. Pandemonium reigned and my bones were liquid with fright—when suddenly the tumult ceased; nor could I imagine through a whole sick day what had been the occasion of the terrifying visitation. But two weeks later the conflict was renewed—at a merciful distance this time. Peering out into the moonlight I beheld one of these Owls perched upon the chimney of the church hard by, gibbering and shrieking like one possessed. Cat-calls, groans, and demoniacal laughter were varied by wails and screeches, as of souls in torment—an occasion most memorable. The previous serenade had evidently been rendered from the kitchen chimney—and I pray never to hear its equal.

Winter.—Bowles (1917b) says:

> The winter of 1915–16 was the coldest and most severe that I have known during a residence of twenty years in the northwest, ice and snow remaining on the ground for weeks at a time. * * * The first migrants of importance to be noted were the Horned Owls, which began putting in their appearance early in the fall of 1916. * * * At first these migrants were regarded only as what might be usually expected here, but soon they became so numerous as to be a veritable pest. Poultry farms of all kinds were raided without mercy, one example that I shall give in some detail being the gamebird farm belonging to Dr. G. D. Shaver, of Tacoma. The captive wild ducks seemed to have the most attraction, and of fifty-three that the doctor had at the beginning of last fall, only twenty-six are left at the present writing—and the owls are hooting there now. The doctor shot a number of them, but killed more by poisoning the carcasses left uneaten. They usually had the heads eaten off, after which the owls would drag them under some log or roll of wire netting where they were well hidden. It is interesting to note that sometimes the owls would not return to their kill for a period of time ranging from one to five or six days. In two instances two owls were poisoned in one night by eating the same bird, and one owl carried a full-grown Mallard hen twenty feet up into a fir tree where both birds were found dead about a week later,

the owl firmly clutching the poisoned body of its prey. I examined a great many stomachs of these owls, the contents of which showed about an equal number of mammals and large birds. Nothing smaller than a Green-winged Teal was found. A number of stomachs contained the remains of hens, curiously enough all of them being Barred Plymouth Rock. This is decidedly strange, because such breeds as the White Leghorn outnumber them in local poultry yards nearly twenty to one. The mammals eaten were confined almost entirely to rabbits and small skunks, or civets (*Spilogale*); * * * in one stomach I found the entire hindleg of a full grown civet. * * * Great as was the flight of these owls in the vicinity of Tacoma, the main abundance seems to have centered in Vancouver Island, as is shown by a letter from Mr. Walter F. Burton, of Victoria, B. C.: "We have a plague of Horned Owls here, which has cleaned out all our pheasants. Hundreds have been shot, but the damage is done. I was out after them yesterday and in a short walk counted fourteen pairs of pheasant wings. * * * Their chief food here is pheasants, grouse, Short-eared Owls and Meadowlarks. Now that they have finished the gamebirds they are eating salt-water ducks; the last one I shot had a Goldeneye. Out of all the owls shot here I have not heard of a rat or mouse being found in the stomachs." * * * The largest bird that I have known the Horned Owls to kill is the Hutchins Goose, which came from the game farm of Dr. Shaver. The killing must have taken place in the water, as the body of the goose was in the lake with the head and neck on a floating log. The body was poisoned and the owl found beside it next morning, the claws of one foot securely grasping the tail of the goose. * * * The method of killing so large a bird was by ripping up the neck, as the head and body were uninjured; * * * the victim is several times as heavy as the murderer. The Horned Owl Invasion, as it might be called, extended at least as far south as Portland, Oregon, where pheasant farms in that vicinity have suffered severely from their depredations. The main line of flight seems to have been on the Pacific coast side of the Cascade Mountains, as on the east side reports do not indicate any very great increase over the usual numbers. Among the many interesting features of the migration of these owls is the fact that at least seventy-five percent of those taken have been females.

This was in the vicinity of Tacoma, and it would be interesting to learn if the males migrated by another route, or even migrated at all. There is no record of a corresponding male owl migration that year. Furthermore, the females examined up to March first showed no indication of breeding, and for any horned owls to wait that late is most interesting. Can it be that the shortage of food and the consequent migration tend to slow up sexual impulses?

BUBO VIRGINIANUS PACIFICUS Cassin

PACIFIC HORNED OWL

PLATE 77

HABITS

CONTRIBUTED BY MILTON PHILO SKINNER

This is preeminently the horned owl of California, where it occurs from sea level up to 7,000 feet above, in all parts except the northwest humid coast region. Its absence from the higher mountains above 7,000 feet may be due to a lack of the food that it prefers. While perhaps not so common in the lowlands as the barn owl, the Pacific horned owl is often seen and reported, both because of its great size and because of the interest that its presence always creates. It lives along the wooded river bottoms of the lowlands, in the wooded foothill ravines, and in the forests of the lower mountains.

Nesting.—This subspecies usually nests on old hawks', eagles', herons', and crows' nests 14 to 60 feet above ground. While the lower body of the nest is neither added to nor even repaired by the owls, there are times when they appear to add a few materials to the top and build up a low rim to prevent the rolling away of the nearly round eggs. As incubation advances, fur, bones, and a few feathers usually collect. In places the Pacific horned owl makes her nest on ledges, or in caves, of a rocky cliff. Sometimes a nest is put in a hollow in a tree trunk, or where a limb has broken or rotted away. Occasionally a nest is placed in a niche in a cutbank. Nesting begins as early as the middle of January, especially in the lower altitudes. Since most of California's lowland trees are along rivers, or about ponds and lakes, there is at least an apparent grouping of the nests near water. Tyler (1913) gives some interesting data:

> Among a clump of willows standing in three or four feet of water I found a pair of Horned Owls nesting on April 12, 1902. They were occupying what may have been an old nest of a Night Heron, a thin frail structure, placed fourteen feet above the water. It measured six inches in width on the inside and nine in length, with the cavity only two inches in depth; but it seemed ample for the great bird that occupied it, and for her three eggs. * * * On April 6, 1906, I examined two more nests of the same species within a mile of the first one discovered. One of these nests was thirty-five feet up, in a partly-dead willow in a field. * * * The other nest was eighteen feet up in a willow in a thick clump that, as in the first instance cited, was growing in water.

Nests as a rule are in oaks, live oaks, cottonwoods, willows, eucalyptus, and sycamores. Apparently any tree that is tall enough and that will hold a nest is acceptable. Nests are not always at the top but sometimes as much as one-third of the way down. This subspecies has also been known to make its nest, and rear its young, in the loft of a ranch barn. Dixon (1914) has recorded of a pair:

> Toward the east end of the Escondido Valley, San Diego County, California, there arises from the valley floor a steep and rocky ridge. On the eastern slope of this ridge and in the big trees of the creek bottom directly beneath, two Pacific Horned Owls (*Bubo virginianus pacificus*) have made their home for years. * * * The edges of the small valleys and clearings are thickly populated with the smaller mammals which make up the principal diet of the Horned Owl. * * *
>
> Records of nesting dates for this pair of birds are available for the past thirteen years. During this time, to my knowledge, there have been killed in this immediate vicinity four adult Horned Owls, but apparently the remaining bird had very little trouble in securing a mate, as the site has never missed being occupied for a single season. * * * This pair has nested in old hawk's nests in trees three times, in an old hawk's or raven's nest in a cliff, twice, and in every other instance has made its home on some rocky ledge on this steep hillside.

Taylor (1894) found a nest on February 22, 1894, at Sargent, Calif., and says: "The Owl's nest was a loose collection of oak-sticks and sagebrush [on a ledge in a cliff], with a curious addition in the shape of a little boy's bow, minus the string. There were a few Owl's feather for a lining, with a great quantity of rabbit bones." Another nest was "in a hole in a 'sand cut,' right next to the railroad track, 4 feet in and about 20 feet from the ground."

Jacobs (1920) records a nest "collected by J. S. Appleton, March 20, 1900, at Simi, Calif. One egg of the Owl and two of the [western red-tailed] Hawk, in a nest on a cliff where the Owls had nested for twelve years. The old Owl was on the nest when found. All three eggs fresh. April 5, sixteen days later, the Owl was again sitting upon the nest which now contained one of the Hawk and two of her own eggs; incubation begun."

Eggs.—Usually there are two or three eggs to a set; but Davie (1889), Beekman (1918), Ashworth (1928), and Bradford (1930) each record the taking of a set of four eggs. Probably there are others. My records of 23 sets show 12 with two eggs each and 11 with three eggs each.

The measurements of 40 eggs average 53.4 by 45.1 millimeters; the eggs showing the four extremes measure **58.2** by 47.9, 52.5 by **48.2**, **49.4** by 43.9, and 54.8 by **43.1** millimeters.

The eggs are pure white at first but later become nest-stained, and sometimes they are dotted with blood, possibly from food brought to the nest. The earliest date I have noted is for a set of two, taken in San Diego County, on January 29, by Joseph Dixon; the latest, April 15, for a set of two taken in Los Angeles County; average for 27 sets, February 26. Since the larger number of these nests were in southern California, a series of more northern sets might show a later average date. Dunn (1899) records three sets taken in May when heavily incubated. These may have been second sets, but if they were first sets they were, as Dunn says, "very late for any sane owl to be house-keeping."

There seems to be some evidence that the incubation of this subspecies may be somewhat more than 28 days, possibly as much as 29 or 30 days.

Dixon (1914) says of the locality in Escondido Valley that he watched for 13 years:

> The earliest date recorded for a complete set of eggs was January 29 (1911), with two eggs; the latest date was February 14 (1907) [with three eggs]. * * * In two instances a period of four days elapsed between the laying of the first and the second egg, incubation starting with the deposit of the first egg. In five instances three eggs, and in every other case two, were a complete set. This pair of birds would invariably deposit a second set, and even a third, within twenty-one days from the time the first set was disturbed. During the wet seasons of 1907,

1908 and 1909 three eggs were laid, possibly indicating that the birds were finding food more plentiful than formerly.

It seems hard to flush a sitting bird of this subspecies from her nest, even before the eggs are hatched. E. L. Sumner, Jr., writes us that on March 14, 1931, a "bird flushed from three eggs when I shook the tree. She flew to a willow along the same slough, about a fifth of a mile away, and perched in the open on a bare branch, facing me. I left and hid in some willows a quarter mile away. In about six minutes she left her post, flew to a willow nearer the nest tree, stayed there about two minutes, and then flew to the nest tree. She lit directly on the nest, walked to the center, fluffed her feathers, and sat down facing my hiding place."

Young.—As with other horned owls, the mother Pacific horned owl, who does most of if not all the incubation (Dixon says "turn about") begins that incubation as soon as the first egg is laid. Since the second egg may be laid as much as three or four days later, and the third egg as much as a week later than the first, there will be that much difference in the dates of hatching, and a corresponding difference in the sizes of the owlets. At first the youngsters are weak and unsteady and not aggressive. In fact they seem drowsy and half asleep. Dixon (1914) says that on March 2, 1913—

> the little owl just out of the shell kept up a lusty cheeping, and when I withdrew a short distance, the old owl returned to the nest without delay. On the 5th of March I again visited the nest and found both owlets out of the shell, and both set up a vigorous cheeping upon the old bird's leaving. * * * Upon settling on her young she made a short hissing noise, not unlike that of a goose but more subdued, and the youngsters would immediately cease their complaint. Three or four times she did this and I at first thought it was directed at me, but finally concluded that it was directed at the youngsters, as they then always became quiet.
>
> As the owlets grew older the parent birds became wilder, never again allowing the intimacy shown during the hatching period. The young owls developed rather slowly until they were three weeks old, but from then on made a marvelous growth. * * * Seven weeks from the time of hatching the two young owls left their nest for good, taking up their abode in the brush and rocks of the steep hillside. They were still unable to fly more than a short distance.

Sumner (1929) says that of two very young "the older whimpers feebly, but cannot stand up yet." A week later both birds were torpid, not offering to move or utter a sound. At this stage they may clap their bills feebly. At the age of 16 days, "young birds as dull and lifeless as ever, offering absolutely no resistance and behaving as though sound asleep." At the age of 21 days, the "youngsters hiss and snap their bills when I approach, but are still far from being wide awake." Eight days later "the young birds rear up and snap their bills when I approach, hissing as I draw nearer, and half opening their wings so as to give themselves a deceptively bulky appearance. They are still as harmless as before." At 37 days of age, "both adults were present, flapping about from tree to tree and hooting in protest, the nest was empty."

At another nest in the top of an oak, says Sumner (1929), one 36-day-old owlet "jumped out and flew 100 yards" across the canyon. The two "remaining young are quite aggressive, snapping bills, puffing out feathers, and half spreading their wings in the inverted manner so characteristic of juvenile owls. They sway from side to side with fiercely glaring eyes, and when closely approached throw themselves upon their backs and strike out viciously with their talons, which are capable of inflicting painful scratches. As soon as I withdraw a few yards, however, they stand upright, hesitating for just a moment as they look about with craning necks, and then commence to flap and hop rapidly toward the nearest cover."

In a copy of his manuscript notes sent to us, Mr. Sumner says that when he climbed to a nest a "young owl about ten days old greeted me. When put down on the ground in the afternoon sun, at 3 p. m., it panted even though the wind was blowing. Two weeks later this young owl was about quarter grown, with immature plumage feathering out all over, bearing on its tips the downs." He says, too, that the nest was becoming foul from old food, bones, fur, and excreta. After the young left the nest, this family kept together for some time. They roosted in the same thicket of low willows for at least two weeks, although Mr. Sumner scared them out every day, and other men soon began using a tractor about 200 feet from the roost. For a detailed study of this subject, the reader is referred to three important papers by E. Lowell Sumner, Jr. (1929, 1933, and 1934).

The Pacific horned owl, like other horned owls, deposits at the nest various kinds of prey for the young. At first this prey may remain for some time, but after the young are ten days old, this food is cleaned up every day. A list of such prey from many different nests includes: Meadow mice, wood rats, pocket rats, pocket gophers, ground squirrels, brush rabbits, young and adult cottontail and jack rabbits, killdeers, shrikes, flickers, jays, band-tail pigeons, coots, and green-wing teals, with rabbits making up fully half of this prey. The item of ground squirrels is interesting because it indicates daylight hunting to capture them.

Plumages.—The plumages and their development are approximately the same as for other subspecies.

Food.—The Pacific horned owl destroys many obnoxious forms of life. In addition to the list just given, stomach analyses have added many additional kinds of mice, Jerusalem crickets, and even scorpions. Dixon (1914) says:

> An accurate account of food found in the nest at the time of the various visits gives us the following: parts of two brush rabbits, three wood rats, and five pocket rats. On only one occasion was there any indication of these owls feeding upon

> other birds, that being a small bunch of quail feathers at the base of the cliff, and I am sure that birds form but a very small percentage of their food. Otherwise we would undoubtedly have found some evidence in the line of feathers in or around the nest. From all my observations of this pair of birds, extending over a long series of [thirteen] years, I would say that they were far more a benefit to the farmer and orchardist than a menace, in spite of the unfavorable reputation this species generally bears.

Of course, this owl will occasionally pick up chickens. On that point Grinnell and Storer (1924) tell us: "The Pacific Horned Owl has a reputation for feeding on poultry, particularly in outlying communities where the fowls are in the habit of roosting in the trees in the barnyard. Mr. George Smith, our packer, told us that in his experience a horned owl would not ordinarily pounce directly down on a sleeping hen, but 'would alight on a limb where a number of chickens were roosting. Then it would crowd against the birds until the one on the opposite side was forced to fly,' whereupon the owl would also take wing and catch its prey when the latter was in motion."

Behavior.—Horned owls have the curious habit of puffing out their feathers when intruders are near, so much so that many persons think they are always that way. But E. L. Sumner, Jr., writes us that "Bubos are like screech owls in that when undisturbed their feathers lie flat, their ears stick up higher (by comparison), and they look slimmer and less birdlike. This one was roosting on a slanting limb of a dense willow over water, and after I had sat still for half an hour, it lost fear of me and lost its original puffed-out appearance."

Although I have found Pacific horned owls so averse to leaving their nests that I could almost touch the nests before they would leave, Grinnell and Storer (1924) say:

> Horned owls, wary birds more often heard than seen, usually will not permit of close approach. It seems probable that in detecting the presence of people they depend fully as much on hearing as on sight. At Lagrange, Mr. Dixon tried several times to get near a horned owl heard regularly on several successive evenings in a certain steep-sided, tree-clothed ravine. Keeping entirely out of sight he tried to approach behind a ledge of rimrock; but the owl, seeming to hear his footsteps, flushed while he was some distance away and still completely out of sight. These owls begin to stir about at dusk and at that time are wont to take commanding positions on the bare tops of dead trees whence they can watch or listen for prey and detect the distant approach of enemies. Their activity extends throughout the night and until late dawn.

There has been some discussion as to the territory concept of these birds, and Dr. Loye Miller (1930) reaches the following conclusions after many experiments: "Bubo hoots from a point within his chosen territory. Within that territory he generally responds quickly to the note of a supposed invader. Calls from without his estates do not bring him to the spot though they may rouse him to send out his own challenge. The male bird is the more aggressive and is recognized by the deeper voice and more regular cadence. * * * When re-acting to the invader, the owl is not disturbed by people. * * * There is honor (or fear) among thieves, for each bird seems to respect the other's territory."

We do not usually think of horned owls as able to swim, yet Sumner says in his notes, of young Pacific horned owls not yet normally out of their nests: "When I arrived at the nest on April 20, 1931, the youngster, then 30 days old, backed up with snapping beak, so hard and fast that he tumbled from the nest, bounced off the wooden rim of my canvas platform beneath, struck a branch below, rebounded from there to another branch, and landed with a splash in Mud Slough. For five or six whole minutes he crouched half submerged in the water, looking about from side to side but not attempting to swim. By and by the young owl began to shiver, making little ripples by his quaking, and after a minute or so of this, and with a couple of preliminary glances behind at the willow from which he had fallen, he turned, and with his wings (I couldn't see his feet) struck out strongly, using the left one more than the right because he was making a right turn, and headed for a stranded branch lying just above water level. When he reached it, he hooked first his beak over it and then tried to grasp it with his claws and scramble up, but it was 5 inches thick, with the under side in water, and he could only make it with one claw, so he hooked his beak over the edge and hung there shivering, with every now and then another attempt for 10 minutes or so. Several minutes later the young owl, by frantic efforts, at last clambered up upon the log and stood there, very wet beneath, and very quiet. The next day the youngster went off the nest onto the canvas platform, frontward this time, and then, standing on the edge, looked, hesitated, and deliberately jumped down with flapping wings into the water and immediately oared across to the opposite shore." Mr. Sumner later threw another similar youngster into the water. It seemed not in the least put out, but, after a slight pause upon landing in the water, swam to shore, using his legs more than his wings, perhaps because he might have been able to touch bottom. "At another nest the young jumped into the water when I was still 10 feet from the tree and floated for at least 5 minutes down the stream without moving a muscle except to turn its head and stare at me. I left him standing in the water, apparently little perturbed."

Voice.—Vocal efforts are much like those described for other subspecies. Sometimes several owls join in making night hideous. At such times it is easy to tell that some individuals have weak, feminine calls while others have much more deep, bass-toned, and booming ones. While the voices of different owls are variously pitched, any one bird calls all night in the same pitch. Late in winter or early in spring, before nesting begins, horned owls often call all night long.

Enemies.—Although horned-owl nests are sometimes found with eggs punctured and broken, and either crows or ravens may be the culprits, there are so comparatively few crows in California that mobbing by them is not at all a common feature. Here, the owls are sometimes mobbed by smaller birds. E. L. Sumner, Jr., writes us about a Pacific horned owl nest: "There were linnets nesting in full song, English sparrows present, and a pair of kingbirds, making a perfect hubbub, but the owls were undisturbed in their midst until the female owl flushed and perched in the tree, when the kingbirds vociferated, orioles called, and the owl was actively attacked by the former. The last I saw of the owl, when she took flight under the attacks of the kingbirds as they clapped their bills with each dive, was when she was flying straight away with the two kingbirds in hot pursuit and one of them about to alight on her back."

Huey (1913) says: "As the old bird left the nest (two miles down the Sweetwater River from Dehesa) a pair of Red-bellied Hawks set out in pursuit. One continued to chase the old owl, while the other hawk returned and robbed the nest of one of the young owls. This was torn to pieces and eaten in a nearby tree." A week later another young owl had disappeared from this nest.

It is conceivable that fly parasites may cause death among at least the young owls. Stoner (1934) says: "I have been puzzled several times when collecting eggs of the Pacific Horned Owl to find in the nest many shiny black seed-like objects about the size of, or a little larger than, grains of rice. These were especially evident in the loose sand about the eggs when they are laid on the shelf of a cliff. They had very much the appearance of seeds. * * * Mr. McAtee kindly informed me that they were puparia of bird flies (Hippoboscidae). Large flat flies are often found on Owls and I suspect that these are adults of these same 'seeds'."

But man and his doings are the greatest destroyers of Pacific horned owls. In addition to directly robbing nests and killing the owls, man plows much ground and thereby destroys and drives away rodents, the common food of western owls. He also chops down trees and thereby decreases the number of nesting sites. Also, Grinnell and Storer (1924) tell us that "Mr. Donald D. McLean says that a horned owl taken 8 miles northeast of Coulterville was captured in a rabbit snare on the ground. At Aspen Valley we found the mummified remains of a horned owl impaled on a barbed wire fence. One wing was broken and literally wrapped around the middle wire of the fence. Evidently the owl had hit the fence while in flight and its struggles to get free had but fixed its feathers more firmly on the barbs of the wire.

Winter.—Hunt (1918) says: "On the night of January 29, 1918, a Short-eared Owl was perched on a rock which crops from the steep gravelly slope" on the campus at Berkeley. Suddenly the dark form of a horned owl "pounced upon it and crunched it into a gravelly crevice of the ledge. * * * For a few moments there was a lively tussle and a great beating of soft wings on rocks. * * * Then the talons of the Horned Owl closed on the breast of the Short-eared, at once piercing the vitals. * * * The Horned Owl, bearing the body of its victim in its claws, flew across the canyon toward a grove of eucalyptus trees." It devoured the breast and other portions.

BUBO VIRGINIANUS ELACHISTUS Brewster

DWARF HORNED OWL

HABITS

This, the smallest race of the North American horned owls, is confined to the peninsula of Lower California, Mexico, apparently about as far north as latitude 30, beyond which it seems to intergrade with *pacificus.* It was originally described by William Brewster (1902) as "similar to *Bubo virginianus saturatus*, but very much smaller." Later Dr. H. C. Oberholser (1904) characterized it as "similar to *Asio magellanicus pacificus*, but very much smaller." Dr. Oberholser, however, goes on to explain this discrepancy by saying: "In *elachistus* there are two very distinct phases, one light, the other dark. Mr. Brewster's type is an example of the latter, which seems to be the more common." Three of Mr. Brewster's adult birds were of this dark phase, but the fourth was much paler, which he thought due to wear and fading.

Mr. Brewster (1902) says of the haunts of this owl: "Mr. Frazar found this Owl nearly everywhere from the coast to the tops of the highest mountains, but not commonly except on the Sierra de la Laguna, where as many as three or four were often heard hooting at once. Mr. Belding had a similar experience, rarely meeting the bird in the low country, whereas it was 'frequently heard and occasionally seen' at the higher elevations. Its preference for the mountains is doubtless due to the fact that they afford the only extensive forests of large trees which exist in this region."

Nesting.—Walter E. Bryant (1889) says: "On the peninsula opposite Magdalena Island, I found in a giant cactus a bulky nest of sticks upon which could be seen two young. At Comondu, an owl of this genus was several times seen at the opening of a small cave high up on the cliff."

There is a set of three eggs in the Thayer collection, taken by Chester C. Lamb on January 31, 1924, at Juan Marcos, Lower California. The bird flew from what was probably an old Harris's hawk's nest, only 12 feet from the ground, in a mesquite tree. The nest was composed of large sticks and was lined very neatly with grass, rootlets, and dried stems. The eggs were fresh.

J. Stuart Rowley writes to me that he took only one set of two eggs of the dwarf horned owl, nearly ready to hatch, from a cavity in a cliff at San Fernando on April 19, 1933. He found another nest on May 8 in a crotch of an immense tree near Mira Flores. This was apparently an old nest of Audubon's caracara; it contained one half-grown young.

Eggs.—The eggs of the dwarf horned owl are like those of the other races but smaller, of course, than those of the larger races. The measurements of nine eggs average 53.3 by 43.7 millimeters; the eggs showing the four extremes measure **56** by **45.5** and **47.5** by **40.9** millimeters.

Behavior.—Mr. Rowley says that the owls at San Fernando were very shy, and he tried in vain to collect the parents of that set. The female always left the nest as he approached by climbing over the rocks where concealment was impossible. He witnessed on another occasion an interesting performance, which he describes as follows: "I was concealed near a pool of water, collecting nighthawks, when I saw a horned owl perch on the top of a cardon, about 100 yards distant. This individual, undoubtedly the male, started calling and in a few minutes was joined by another bird, undoubtedly his mate, on the top of another arm of the same cardon. The first bird continued his hooting and proceeded to bow up and down in rhythm with each hoot, accentuating the last hoot and bow of each performance. This lasted for several minutes intermittently until I broke the silence of the evening with a shot at a nighthawk, whereupon both owls left."

BUBO VIRGINIANUS HETEROCNEMIS (Oberholser)

LABRADOR HORNED OWL

HABITS

When Dr. Oberholser (1904) named this large, dark race of the horned owls, he described it as "like *Asio magellanicus saturatus*, but bill larger; posterior lower parts paler; feet lighter colored and less heavily spotted; upper parts with usually less ochraceous. * * * Although by authors heretofore referred to *saturatus*, the Labrador bird differs from that form as detailed above, and its characters, though not as strongly marked as are those of some of the other races, are yet sufficient for recognition by name, particularly in view of a widely separated range. Although, of course, nearest *saturatus*, the differences may be readily appreciated in a good series."

As birds from Newfoundland, of which we have a good series in Cambridge, are not sufficiently different to warrant recognition in nomenclature, Newfoundland is now included in the range of this race, as are also northern Ungava and Nova Scotia. Dark-colored horned owls, occasionally taken in winter in New England and

Ontario, which were formerly reported as *saturatus*, are now recognized as migrants from the range of *heterocnemis*.

Lucien M. Turner says in his unpublished notes: "So far as my own experience was concerned, I found the horned owl to be comparatively rare in the Ungava district. From intelligent and trustworthy sources, I have learned that this species of owl is quite common near the head of Hamilton Inlet and the southern portion of Labrador. The character of that region would indicate a greater abundance of birds of prey than in the sparsely wooded district of Ungava."

Nesting.—Walter Raine (1896) reports a nest found at Sandwich Bay, Labrador, April 17, 1895, and the label says: "The nest was built in a spruce 15 feet from the ground, and made of twigs and coarse grass." There is a set of two eggs in the Thayer collection, taken at the same place by the same collector on May 1, 1896, with the following data: "Nest made of sticks and weeds in tip of a spruce." I have two sets of three eggs each in my collection, one from Hopedale, Labrador, and one from Grand Lake, Newfoundland, but no description of the nests came with them.

Major Bendire (1892) quotes Henry Reeks on a Newfoundland nest, who says: "The only nest that came under my observation was built on the ground on a tussock of grass in the center of a pond. The same nest had been previously occupied for several years by a pair of Geese (*Bernicla canadensis*)."

In Florida, in Texas, and in Newfoundland, the great horned owl has been reported as nesting on the ground. J. R. Whitaker has sent me the following interesting notes from the latter locality: "On April 1, 1922, I crossed over on the ice to an island in Junction River. Part of this island is covered with a thick growth of spruce, and the rest is more or less barren; on this bare part stands the stump of what must have been a large pine tree, about 15 feet high. * * * Floods have washed the soil away from under the roots of the old stump, leaving it standing on a tripod of roots. The snow was piled up all around, except on one side; as I approached and was quite near, a great horned owl scrambled out and flew to a pine tree about 30 yards away, where it was joined by the male bird; both of them snapped their bills loudly and hooted at me. I looked under the stump, and there on the frozen ground, surrounded by snow, lay the eggs. There was no nest, only about half a dozen owl's feathers. The bird had made quite a beaten track going in and out. Directly after the thaw came, the nest was submerged under 2 feet of water. The owls then moved a distance of about 300 yards and laid a second clutch under a prostrate dead pine, which had rolled from the top of a very steep, sandy bank and lodged about halfway down; the roots held the butt end up about 12 inches; stones and soil had rolled down the hill and filled all the back part of the log up level, making a snug cavern for the nest. Here the owls had evidently nested for years, as there was a large accumulation of pellets and bones of muskrat and rabbit. There was no nesting material but these old beaten down pellets and bones. It is hard to conjecture why these birds chose to nest on the ground when, within less than a mile, there are several good nesting places which were frequented regularly a few years ago, when the bird was much more plentiful than it is at the present time."

This ground-nesting habit is not universal in Newfoundland, however, for while I was there in 1912 I was told by reliable guides of two nests of this owl on broken-off tops of pine trees. The only places where I saw this owl were the heavily timbered regions along the streams.

Eggs.—The Labrador horned owl apparently lays either two or three eggs. These are similar to the eggs of other horned owls but seem to average slightly larger than those of *virginianus.* The measurements of 17 eggs average 56.2 by 47.4 millimeters; the eggs showing the four extremes measure **60.7** by 46.7, 56.3 by **48.3, 53.9** by 46.3, and 54.3 by **45.2** millimeters.

This owl evidently does not differ in general habits from other races of the species. Mr. Turner had an experience with one that seemed to indicate that horned owls have a keen sense of smell. He had a lot of small birds, wrapped in papers and hung up in a cloth bag; the owl found the bag, tore it open, and devoured over a dozen of the birds.

This is one of the northern races that might be expected to make extensive fall and winter migrations in seasons when its northern food supply becomes scarce; and so it undoubtedly does, for it has been occasionally taken in winter in Ontario and various parts of New England. On the south coast of the Labrador Peninsula, we saw no evidence of horned owls in May and June, but we were told by the residents that they were not rare on the coast in winter. Ptarmigans flock to the coast of Labrador in winter but retire to the interior in summer, and their movements seem to be followed by a corresponding flight of horned and snowy owls. On the northeast coast of Labrador, however, no such migration seems to take place, for we were told that horned owls are fairly common there at all seasons, in all suitable tracts of heavy timber.

BUBO VIRGINIANUS ALGISTUS (Oberholser)

ST. MICHAEL HORNED OWL

HABITS

This race, which is supposed to breed on the coast region of northwestern Alaska, from Bristol Bay to Kotzebue Sound, was described by Dr. H. C. Oberholser (1904) as "similar to *Asio magellanicus lago-*

phonus, but much paler throughout; the lower parts less heavily barred; the legs and feet not so conspicuously mottled. * * * This subspecies of *Asio magellanicus* really much more resembles *occidentalis* or *pacificus* than it does its nearest geographic relative, *lagophonus;* but is not identical with either. From *occidentalis* it may be separated by its darker upper surface, particularly the wings, and by its somewhat less heavily barred lower surface; while from *pacificus* its larger size, less ochraceous face, and the paler ochraceous of the upper surface will serve for differentiation."

Nearly all we know about the habits of this owl is contained in the following account of it by Dr. E. W. Nelson (1887):

> Throughout the entire wooded part of Northern Alaska the present bird is found extending its range in autumn to the open treeless shore along Bering Sea and portions of the Arctic coast. In several instances at Saint Michaels I found them perched on our wood-pile in the evening, late in autumn, and saw others, now and then, using for a lookout the upright stacks of drift-wood we had placed above high-tide mark for winter use. When traveling at night along the Yukon in midwinter I have frequently heard the hollow notes of these owls echoing from the black recesses of the spruce forests which wall in the river down to within a hundred miles or so of its mouth. This sound, with the sharp bark of a fox, or the much rarer cry of a hare as it is caught by a lynx, or, rarer still, the long-drawn howl of a wolf, are the only noises that greet the ear of the weary traveler.

Nesting.—Dr. Nelson (1887) says: "Near Fort Yukon Kennicott found them breeding on April 10, and describes the nest as a very large structure made of dry spruce branches placed in a spruce tree standing amid a dense growth of other trees of its kind. This date, however, is probably somewhat earlier than usual, as would appear from the size of the young which I have seen brought to the sea-coast by the fur traders, which were not half grown by the middle of June."

Eggs.—I have been able to locate only six eggs of this owl, three sets of two eggs each. The measurements average 55.5 by 47 millimeters; the eggs showing the four extremes measure **55.8** by 48.5, **55.1** by **49.4**, and 55.5 by **45.4** millimeters.

Food.—Dr. Louis B. Bishop (1900) says that, on his trip down the Yukon, "owl pellets, some of them remarkably large, containing chiefly bones of rabbits, ground squirrels, and red squirrels, were found in great abundance, especially at Caribou Crossing and on Windy Island, Lake Tagish, but the most careful hunting failed to disclose the owls."

BUBO VIRGINIANUS LAGOPHONUS (Oberholser)

NORTHWESTERN HORNED OWL

HABITS

In naming and describing this race, Dr. H. C. Oberholser (1904) says: "This subspecies differs from *pacificus* in its larger size; darker upper and lower parts, the latter more heavily barred; more strongly mottled legs and feet; darker and more rufescent facial disk." This race is nearer in color to *saturatus* than to any other race, but it is not quite so dark; there is also more ochraceous and rufous in the face and elsewhere in *lagophonus*.

It occupies an adjacent range in the mountainous interior, northward to the interior of Alaska. Dr. Oberholser (1904) says, however: "It is possible that I err in referring to *lagophonus* the Alaskan specimens of *Asio* from the timbered region, for it may well be that these large birds are but the dark phase of *algistus*, yet in so far as the material now available shows, save in one single instance, the difference in plumage is correlated with change of area, the lighter birds being confined in a general way to the Barren Grounds." As horned owls are timber loving birds, it hardly seems likely that they would be anything more than wanderers on the Barren Grounds; and they most certainly must breed in the timbered regions. For this reason, I have treated all the records from northern Alaska as referable to *algistus*.

Nesting.—W. Leon Dawson (Dawson and Bowles, 1909) says: "Nesting begins earlier than in the case of any other resident species, and fresh eggs may be looked for by the third week in February, whatever the state of the weather. Hollows in trees are sometimes used, and if so, receive no lining; but old nests of hawk, magpie, or crow are more commonly employed."

On March 9, 1887, in Yakima County, he says: "I took a set of two eggs well incubated, from an old nest of Swainson's Hawk, forty feet high in a giant balm tree. A few weeks later I came upon a set of four, laid by the same bird, in an old Crow's nest in a neighboring poplar grove; and again, a month later, a set of two in another Crow's nest not a hundred feet away. These last I spared, for one does not always contest the rights of motherhood, even in tigers."

Major Bendire (1892) says that "quite a number nest in the wind-worn holes in sandstone and other cliffs, small caves in clay and chalk bluffs," and "in some localities on the ground."

Eggs.—The northwestern horned owl evidently lays two to four eggs, which are indistinguishable from the eggs of other horned owls. The measurements of 11 eggs average 54 by 44.5 millimeters; the eggs showing the four extremes measure **57.1** by 44.4, 52 by **46, 51** by 44.2, and 52 by **43** millimeters.

Food.—Mr. Dawson (1909) writes: "The food of the Horned Owl in Eastern Washington consists of rabbits, and all the various rodents which infest meadows and sage, together with birds of many sorts, especially grouse. They easily cultivate an acquaintance with the poultry-yard, and if well fed, become so fastidious that they will have nothing but the brains of a fowl. Naturally, this epicurean taste is resented by intelligent ranchers, and the day of the Horned Owl is slowly waning."

Behavior.—The following incident, related by Mr. and Mrs. Thomas T. McCabe (1928), illustrates the strength and vitality of this great bird:

> On or about June 1, 1927, one of us knocked a Great Horned Owl (*Bubo virginianus*) out of the lower branches of an aspen with a charge of small shot. The slow, wheeling fall, with open wings, was characteristic of a dead bird, so the gunner took his time and was rewarded by an hour's search, several large secondaries, and no owl. In another case, on November 4, 1927, the junior author was more fortunate and brought in perhaps the most superb owl we have seen in this land of owls, splendid not only in size and general condition, but covered with a blanket of pure white fat of a depth which would have been surprising on the fattest of waterfowl. By chance we skeletonized this specimen, and found that, at some earlier date, the ulna had been completely shattered for a length of about an inch and a half, and had knit, at a somewhat false angle, in a large, perforated bony mass. The principal metacarpal bone had also been smashed, and had knit in a similar way. The probability that this was the missing owner of the secondaries was very strong. Such a condition presupposes other "ills we know not of", for the side and back must have been badly peppered. The owl had been able to maintain life without flight for a considerable length of time, in spite of the abundant coyotes, and either kill some prey under the same conditions or endure an amazing fast and still regain its superb condition within one short northern summer.

Dr. H. C. Oberholser (1904) described a race from the coast of California which he named *icelus*, but which has never been recognized in the A. O. U. Check-List; he described it as resembling *pacificus*, "but very much darker particularly on the upper parts." The type was taken at San Luis Obispo, Calif., on November 29, 1891, and was evidently a winter migrant, as this locality is well within the breeding range of *pacificus*. Dr. Louis B. Bishop tells me that *icelus* is a perfectly good race, much like *lagophonus*, but smaller, breeding from Tillamook County, Oreg., southward along the coast region to Monterey County, Calif., and ranging north to Thurston County, Wash., and south, in winter, to Los Angeles County, Calif. He has 21 specimens in his collection, from the above and intermediate localities, which are uniformly referable to this race.

Dr. Bishop (1931a) has recently described a new race from Victoria, British Columbia, which he names *Bubo virginianus leucomelas;* he says that it is "similar to *B. v. lagophonus*, but with the ochraceous replaced with grayish white throughout the plumage, except for a little pale ochraceous in the interscapular region. Though collected in the breeding range of *B. v. saturatus* its relationship is nearer *lagophonus*, as it replaces the sooty black of the former with the more grayish black of the latter—almost Ridgway's 'blackish brown (2)'. The abdomen is more distinctly barred than in either of these races and the pale markings are more profuse above. The tarsi and toes are heavily spotted and barred with black on a grayish white ground." The type was taken near Victoria on January 19, 1927, where it was doubtless a winter migrant only. In addition to the type, two others about typical and five more, variously intermediate with *subarcticus*, were taken in that general region. Dr. Bishop thought that it might breed east of the coast range in northern British Columbia, near where the ranges of *lagophonus* and *subarcticus* approximate; and he now tells me that H. S. Swarth since found it breeding there.

BUBO VIRGINIANUS OCCIDENTALIS Stone

MONTANA HORNED OWL

Plate 78

HABITS

Contributed by Milton Philo Skinner

I should call the Montana horned owl rather unsuspicious, at least in such a place as the Yellowstone National Park where I knew it best. Sometimes I would see them watching me as I rode past them on horseback. Apparently they were attracted by lights, perhaps through curiosity, for I would frequently see them by the headlight of my auto, acting in such a way as to indicate that the light itself was an attraction. Several times I have had them visit my camp and circle about, above the campfire, or alight in a nearby tree.

Lewis and Clark killed a Montana horned owl in western North Dakota on April 14, 1805, probably the first one of this subspecies to be secured by a white man. Later, others found them rather common in many places. Williams (1926) says they were still quite numerous in North Dakota at that time.

Spring.—Over much of their range Montana horned owls do not migrate. In the Yellowstone Park most of them usually disappear in October and return in March. But this park is all high, mountainous country, and the movement is more or less forced by deep snows and lack of food. Probably these birds, in such regions, move up and down with the seasons, without its being an actual migration.

Nesting.—The Montana horned owls in Colorado, Wyoming, and Idaho, at least, often make their nests inside of old magpie nests, and still oftener lay their eggs on the tops of these bulky balls of twigs. Bergtold (1928) says they breed up as high as 11,000 feet above sea level in Colorado. And Sclater (1912) says: "In Colorado the Horned Owl is a fairly common resident, breeding over nearly the whole of the State from the plains up to timber line, according to Drew, and wandering up to 13,000 feet in the fall."

One pair had a nest on an old magpie nest, 20 feet above ground, in a grove of cottonwood trees about 3 miles east of Aurora, Colo., according to Leon Kelso (1929a), in 1925, and in similar places nearby in 1926 and 1927. These nests were in rather a public place, but the owls slowly became tamer and less disturbed by the autos and picnickers below them.

Rockwell (1908) gives a good description: "The nest was a badly dilapidated magpie's nest from which all the top had weathered away except a portion which shielded the bird from the north, leaving a rather flat platform of sticks not unlike an old hawk's nest, and was situated about 15 feet from the ground in a small cottonwood tree about 8 inches in diameter. The depression of the nest cavity was quite shallow and was unlined except for a thin layer of feathers from the parent's breast, upon which, together with some dead leaves and similar trash the egg was deposited."

Lowe (1895) says that "here in Pueblo County, where diminutive junipers struggle for existence among the limestone hillsides, and whose branches, unlike those of the gigantic sycamores, sweep the ground rather than the sky, *Bubo virginianus* [*occidentalis*] nests at a very low height. It is unusual to find a nest higher than twenty feet, and fifteen feet is about the average, while twelve feet and even eight are not infrequently noted. Nesting sites of birds very often appear to be governed by surroundings. Thus it will be seen that the Western Horned Owl, when nesting in a locality like the above, is compelled to build very low." Other naturalists have noted this also. Silloway (1901) says:

> As the female was thus abroad, it was necessary for me to climb to each suspected nest, not knowing the precise site; and guided by my experience with Bubo in Illinois, where sycamores grow tall and Bubos nest high, I ascended to several that were conspicuously high. At length, having examined all the likely sites, I concluded that the occupied nest must be an insignificant affair in the top of a slender tree. Pushing through the thicket to reach the tree, I discovered a large lean-to nest against the trunk of a small tree, the distance of the structure from the ground being only ten feet. * * * I scrambled up the trunk from sheer force of habit, and ah, there were two eggs.

Seemingly, Montana horned owls do not often make nests of their own. Even when it comes to material added to an old nest, there is quite a bit of variation as to presence of any nesting material at all. V. L. Marsh writes us of a nest where the eggs were lying upon the bare, rocky material of the site without any other material of any kind. In places these birds make their nests on the ground. Cameron (1907) says that this owl "nests indifferently in the river valleys or pine hills. A pair of Hoot Owls reared their young on my ranch in Custer County for many years, repairing the same nest, often but a storm swept fragment, each spring in the same box-elder tree. Almost before winter is fairly over (about third week of March) the female begins to lay. * * * While one of the pair is on the nest, the other sits silent in a tree, its plumage assimilating so closely to the bark, whether box elder or willow, as to render the bird invisible even when the tree is leafless." Mr. Bent (1907) has noted that "the deserted nests of the larger hawks were sometimes occupied by Horned or Long-eared Owls." And he also says that one pair used one of the old heron nests in the great blue heron rookery on Skull Creek, Saskatchewan. These adopted nests include those of red-tailed hawks, Swainson's hawks, ferruginous roughlegs, and in fact all hawks that build nests of sufficient size and proper character. Apparently Montana horned owls nest at all heights above the ground up to 70 feet. The hawk nests they use average about 40 feet above the ground. Higher than that, they must be in sheltered places more or less out of the wind.

In the Yellowstone National Park these birds nest in March, on the tops of stubs or thick trees, and at least once a pair nested in a niche in a cliff near Gibbon Falls. On June 25, 1917, I found a deserted nest on the top of a 20-foot stub standing alone in a little embayment facing east, in the fir forest above Mammoth, and overlooking an open mesa and the Gardiner Valley beyond. These owls came back again and again for many years to this old nest until a wind of unusual strength toppled the old stub over. Sometimes the old bird would refuse to leave the nest even when stones and sticks actually struck the nest below her. In spite of the reputation of horned owls for ferocity, these were devoted mates, and were actually affectionate to each other, as well as to their young. The nests I found in the Yellowstone were all in the mountains where there were no magpie nests to serve as bases.

Wolfe (1912) found an unusual nest in western Kansas, in a large hole in a clay bank. On March 24, 1910, a female owl was in this hole, which was 2 feet deep, and the eggs in a slight depression, with no lining. Wolfe (1912) also says that in western Kansas, the nests are usually in holes and fissures in limestone ledges along the streams. On March 25, 1909, "after a great deal of climbing and looking into many holes and crevices; we at last located a nest containing one egg. The nest was in a crevice in the face of a cliff about forty feet up. The crevice was parallel to the base and perhaps ten inches wide. * * * It [the egg] was lying in a depression nearly round and fourteen inches in diameter by seven inches deep, and contained no lining. From all appearances and the amount of debris, bones and etc., lying near the nest, this site had been used for many generations and by constant use the depression had been worn in the solid rock. Neither of us touched the egg or put our hands in the crevice, hoping to secure a complete set later. During our stay at the nest we did not see either of the birds. April 8, we returned, * * * but the nest had been deserted." Of another nest, Wolfe (1912) says: "A careful search was begun and resulted in flushing a female from a nest containing two eggs. This nest was * * * situated in a very open place, being on a ledge not over eight feet up. The eggs were in a depression over two inches deep hollowed out of the sand on the ledge."

Eggs.—This subspecies usually has two and often three but rarely four, white eggs. The measurements of six eggs average 54.8 by 46.3 millimeters; the eggs showing the four extremes measure **56.5** by **48.2**, **53** by 45.5, and 54.6 by **45.3** millimeters.

Strange to say, the earliness, or tardiness, of the season seems to have little to do with the actual laying of the eggs. My experience has been that the period of incubation is 28 days, usually performed by the female, although the male sometimes takes her place temporarily. But Cameron (1907) says the male sits alternately with her, and shares the duties of incubation. On the other hand, Sclater (1912) says that incubation is "undertaken entirely by the female." Sometimes, while the female is on the nest, the male will be close by and may even be found crouching on the nest beside his mate (Treganza, 1914). While their eggs are still unhatched, the adults do not ordinarily resent intruders. Rockwell (1908), of Colorado, writes: "A week later [March 17] we returned. * * * The owl evidently heard us and as she raised up we could plainly see her head above the rim of the nest. We promptly got our cameras into action and after making a couple of exposures from the ground, climbed a tree about 25 feet from the nest. * * * This did not seem to frighten her, but when we got half way up a tree within 15 feet of the nest the old bird flopped off the nest and out of sight. An examination of the nest revealed two eggs in which incubation had begun. The nest contained many more feathers than on the previous week."

Donahue (1923) says of a Kansas pair: "Clyde was almost up to the nest before the old owl flew off. * * * The male soon came sliding through the woods from up the draw, and joined its mate in protestations in the form of beak clickings and deep '*Whooo-hoooos*' from trees around about."

Wolfe (1912) says that he took two sets of eggs, one of four on March 24, 1910, and just one month later two eggs that were not quite so large. And I think I am correct in writing that it is usual for the second set of eggs to be both fewer in number and somewhat smaller in size. Sclater (1912) says that: "Gale found it a most persistent layer; he took three sets of eggs from the same pair of birds; the sets numbered four, three and two respectively, and the nest-site was changed each time."

Young.—With the arrival of their young, the parents become fiercer, and may later boldy attack any person approaching the nest. Cook (1926) says that he found a nest tree, "an easy one to climb and I was making fairly good progress toward the nest and had gotten within about six feet of it, when the unexpected happened. Mrs. Owl who had perched on a tree nearby to watch the proceedings, suddenly swooped down upon me, striking me such a blow on the top of the head that my cap was knocked off and for a moment it made me wonder whether I was going up or coming down. In order to avoid a second attack I had to wave my arms frantically about my head, as I now had no covering on my head a second attack might have proved much more serious * * * when I looked into the nest there were two nice little owlets, doing their best to back away from me." Neilson (1930) writes: "I still carry scars on my arms received in repeated attacks by a pair of old birds when I was engaged in securing pictures of the young in the spring of 1921. Their method of attack was to launch themselves from a tree and fly straight for my face and only once did they attempt their attack from behind and my stockman's jacket was all that saved my neck a severe laceration. Knocking them to the ground once or twice seemed only to make them more determined."

Making use of the dates for fresh eggs already given and adding 28 days, we may look for young owls as early as the middle of February, in Kansas, to the last of April, in Manitoba. Some owlets have been found in their nest as late as July 10, but these were, no doubt, from second settings.

Cameron (1907) says that the owlets are so pugnacious "that the strongest finally drives the others from the nest to occupy a branch near, where they pretend to fight but avoid the real issue by twirling round and hanging head downwards by their scansorial feet."

By the time the youngsters are two months old they are as large as the adults. About that age they learn to fly and then leave the nest. After that, although they may fly to neighboring trees, they sometimes keep in the vicinity of the nest for as much as a month longer, before finally leaving.

Warren (1911) records that at one nest with three young there were: "As a food supply, the hindquarters of a cottontail rabbit, a pocket gopher (*Thomomys*), and three young Pinyon Jays, just about large enough to leave the nest. The heads of these latter were missing." Donahue (1923) says of a nest containing three very young owls, that there were "several parts of rabbits in the nest cavity, also a freshly killed Bobwhite." Later, he found flicker feathers there.

Plumages.—Owlets just out of their eggs are blind and so nearly naked that they look like pink featherless lumps of flesh. They are then about as weak and helpless as birds can be. But in a few hours, possibly as soon as dry, the white down shows. Five days later white pinfeathers have started. The eyes open when they are about one week old, and at that age the eyes are brown. At ten days of age the white down covers the body, and the pinfeathers that have been growing under the down begin to show. During the next week changes are quite rapid. About the twelfth day, the previously white plumage begins to acquire a brownish tinge, and the owlets begin to snap at intruders, perhaps in imitation of their parents. At this stage the owlets are about the size of pigeons. Pinfeathers appear at edges of wings and tail and grow rapidly, while down still continues over considerable areas. At 20 days of age the color of the iris changes from brown to yellow, getting brighter and clearer day by day; feather marking begins to appear. Ear tufts appear when the birds are 20 or 25 days of age. After this the remaining tufts of white down gradually get soiled, and the general color of the owlet grows buffy on body and wings as more and more feathers develop. Warren (1911) secured an owlet on May 10, 1901, at Paonia, Colo., that was presumably 41 to 45 days old, and says: "It stands about twelve inches high. The body plumage is mostly down, but the wing and tail feathers are well grown, and about half out of their sheaths. The ear tufts usually stand up about one-half inch but sometimes three-quarters of an inch. The feet and legs are thickly covered with a yellowish or light buffy down. The whole of the body down, both above and below, is barred similar to the adult, and is fully two inches thick on the breast. This down is a light yellowish brown, but light gray on the tips. The wing coverts are brownish yellow, with dark, nearly black, bars a quarter of an inch wide. The primaries and secondaries are as dark as the bars of the coverts, with still darker bars. The tail similar. The face markings and feathers are just beginning to show." At two months of age, the young owls are full grown and a trifle lighter in color than adults, perhaps still retaining a few tufts of down on the ends of some of their feathers. Grinnell, Dixon, and Linsdale (1930) weighed "a male and a female from near Termo [northeastern California], October 11 and 12, 1924, at 1160 and 1184 grams, respectively."

Food.—About 11 a. m. of a cloudy day, while riding in the Yellowstone Park, I saw a Montana horned owl fly low across a high mountain prairie and finally alight on a sage 2 feet high, hop to one side, catch a ground squirrel, and fly off with it to a nearby thick grove of lodgepole pine. At other times I have found the remains of snowshoe rabbits, caught by these owls, on the hot-spring formation at Mammoth. Like other subspecies described, the Montana horned owls eat various kinds of mice, rabbits, rats, skunks, ground squirrels, pocket gophers, prairie dogs, an occasional bird, and unprotected chickens that sleep out.

Grinnell, Dixon, and Linsdale (1930) record, of the pair taken near Termo, that "the stomach of the male contained one red-shafted flicker and one meadow-mouse. The female had eaten a California jay and a bushy-tailed woodrat."

Cameron (1907) says: "They were observed to kill half grown turkeys belonging to J. C. Braley, of Terry, in the summer of 1902. The season's menu for our own particular owlets consisted, however, mainly of cotton-tail rabbits, two of which have been seen in the nest at one time. I once saw a young jack rabbit in the nest." And he also observes that one nest was once supplied with a long-eared owl and a sharp-tail grouse, but during the time that the young were growing no other birds were eaten at the nest.

Merriam (1891) has recorded that one killed at Saw Tooth Lake, Idaho, on September 30, 1890, had in its stomach, "two Pocket Gophers (*Thomomys*), one White-footed Mouse (*Hesperomys*), one Field Mouse or Vole (*Arvicola*), and a new species of *Phenacomys*."

So far as economic value is concerned, this owl, like the other western subspecies, seems more destructive of obnoxious forms of life than of game and poultry. Donahue (1923) says: "In this instance at least, though there was a chicken farm within a half mile from the nesting site, poultry formed not a single part of the food fed to the young. As far as I was able to find out and discover, with the exceptions of the bobwhite and the flicker already spoken of, the food of the great horned owl [and three young ones] consists wholly of cotton-tail rabbits." Warren (1911) adds even more valuable testimony for the owl: "While staying at Gaume's ranch in the northwestern part of Baca County, the last of May, 1905, a pair of Horned Owls had two young in a hole or small cave in the sandstone bluffs which formed the back of the corrals. * * * I estimated this as thirty feet above the bottom of the bluff, and ten below the top. * * * The people at the ranch told me the owls had never molested their poultry though there were many chickens of all sizes and ages running about everywhere below the nest."

Mr. Kelso records an instance near Aurora, Colo., where English sparrows built a nest in the interstices of the owls' bundle of sticks. He (1929b) also says that "Desert Sparrow Hawks, Lewis Woodpeckers, Red-shafted Flickers and Magpies nesting in the immediate vicinity were not disturbed, to my knowledge, although individuals of those species were brought to the young owls for food."

Rockwell (1908) sums up:

> It has been said and possibly it is true that the Horned Owl is the most destructive of North American birds, but even if this be true, it is certainly a fact that what damage the comparatively few individuals of the species, to be found in any given locality, really do is not sufficient to brand them as a natural menace, and the amount of good they do in destroying small rodents should certainly be a strong point in their favor.
>
> But when all other arguments for a sweeping bird protection fail to convince, we can always fall back on the fundamental fact that Nature knows how to conduct her affairs very well and if those who are over-anxious to exterminate any creature regarding whose economic usefulness there is a question would rest from their labors of carnage and let the natural laws take their course, the ultimate results would probably be fully as satisfactory. * * * Why not let a wise Nature of which man is but an insignificant part rule without our interference?

He says also that the early date of nesting, and the quiet and retiring ways of the birds at that period, probably account "for the way in which these birds withstand constant persecution, not only from hunters but from ranchmen as well, for every farmer seems to feel it a solemn duty to do his share toward exterminating the entire owl family."

Behavior.—I found these owls in all parts of Montana and Wyoming from the lowest elevations up to at least 8,000 feet above sea level, but much commoner in the lowlands. At night they are apt to come out into the open valleys and meadows; but during daylight they usually keep more or less concealed in the thick foliage of lodgepole pine, limber pine, fir, spruce, cottonwoods, or aspen groves. They are, therefore, never far from wooded regions in daytime unless there are caves to hide in. During daylight they are apt to perch on limbs close to the trunks of the trees; but at dusk, I see more of them perched on isolated dead trees, dead stubs, or telephone poles. I have also seen them, on cloudy days, perched momentarily on low sage bushes, or even at times on the ground of grassy knolls. Of course, I have seen still more of these birds at night; but on at least one occasion I saw one flying just above the forest trees, in the bright sunlight.

Once I saw a pigeon hawk, a western red-tailed hawk, and a Montana horned owl all in the same dense thicket; but I never could find out why they were together. At one of my camps a horned owl, a short-eared owl, and a screech owl came flying about camp at different times the same evening, but they did not appear together at any time.

In Yellowstone Park these horned owls seem actually to like the hot-spring and geyser areas. I often saw them in the forest covering the old part of the hot-spring formation at Mammoth, apparently living there at all seasons. Possibly this was due to the trees there being very thick and heavy and having good nest sites. Also, there were large numbers of ground squirrels, mice, and young rabbits nearby. On August 8, 1927, I found an owl roost in a grove of thick trees on the river bank half a mile below the Sentinel Geyser at the lower edge of the world-renowned Upper Geyser Basin.

Although the birds generally threatened me when near the nest, they were usually silent when they really meant to attack. Then they dived with a swift, sure rush that was deadly in its silent power. When they struck, the blow from their fist was painful and their claws would cut through all but the heaviest padding. Once I found two coats, a heavy sweater, a vest, and two heavy woolen shirts too light, and the owls drew blood from my neck and shoulder. After delivering a blow, the attacking owl would continue its swift, level flight beyond me for a hundred feet before swinging to the left and upward to return for another attack. Both the males and the females delivered these blows, but I thought the larger's attack, and therefore likely the female's, was a little the more frequent and vicious. The viciousness of the attacks seemed to increase with the increase in age of the nestlings. V. L. Marsh writes us: "On April 22, I made an attempt to get to the nest. I was stretched out on the face of the cliff when the female swooped down and drove a pair of sharp claws into the back of my horse-hide coat. About 15 feet behind her came the male, but he veered off past me as I let out a loud yell. I don't know why I had that leather coat on, but I always wore it after that."

Although the Montana horned owl normally roosts during the day in thick tree foliage, Kelso (1930) says: "A trait that I had not observed before in these birds was their roosting among the grasses and weeds on the damp ground below the trees during the hot days of June."

Voice.—The Montana horned owl has the usual note of horned owls, a loud, mellow *Whoo-hoo-hoo-oo-oo,* a stirring night sound that is ever thrilling to lovers of the wilder aspects of nature.

Once, while I was in camp at the upper end of the Slough Creek meadows in Yellowstone Park, a Montana horned owl came and alighted, at dusk, on a tall fir, where it went through the motions of hooting, although no sound issued from its beak. Most of the time its horns lay back on its head, but once or twice it erected them. I do not think that it saw me, but it kept turning its head to look away from me down the open valley. At another time, I heard an adult owl on a dead lodgepole pine utter a whistling cry.

When the old birds dived at me, they snapped their bills and hissed while still some distance away. This snapping was an angry, threatening sound easily heard when the coming birds were still a hundred feet away. Kelso (1930) has given an excellent account of sounds at a nest: "On March 23 [1923], the female was sitting. * * * At 7:35 p. m., the male came to the nest and a conversation of deep *whoo-whoo's* followed, lasting for ten seconds or more. Also one of the birds uttered a shrill *chee-chee-chee* call." [The young were hatched during the third week of April.]

> On the night of April 27, the female was hovering the young. At 7:00 p. m. a muffled *chee-chee* began coming from the nest, with, occasionally, a harsh rasping note. After about five minutes, the mother owl arose, stood on the edge of the nest for a second, and then flew away over an open field to the south, uttering the rasping call as she went. The notes of the young bird became louder and more continuous, resembling the cheeping of a young chick. At 8:05 p. m. the mother returned, evidently with some article of food, for the owlet was silent from then on. * * * While watching the nest May 28, one of the parents was seen to alight on it at about 9:00 p. m. * * * After a few minutes the adult flew down the creek. The young owl called after it a rasping *peerahhh* and the parent answered by the same note. This calling and replying continued about five minutes, the sounds varying in length and sharpness, sometimes amounting to a scream. A parent once uttered a whistling *whee-whee* note. A short period of

silence passed and then both parents were heard in a tree near the nest, holding a confused conversation, one uttering the *whoo* and the other giving *erreeuh* calls accompanied by a loud snapping of the beak. The latter was evidently the female. * * * Another of her calls was a series of sharp *tchi-tchi-tchi* sounds, ending in a harsh screech.

Enemies.—On one occasion, as a Montana horned owl flew off through a lodgepole forest, I heard a pine squirrel scolding it. On May 24, 1916, I heard a western robin chirping rapidly in some evergreens. When I got there I found two owls perched in the *flexilis* pines. So far as I could see they were neither injuring nor molesting the robin in any way. Crows are not common over much of the range of the Montana horned owl and there is little mobbing of owls by them.

Fall.—Little is known of any seasonal movements. Still, W. Ray Salt banded two horned owls at Rosebud, Alberta, on May 23, 1930. One was shot at Antelope, Mont., 400 miles distant, on January 8, 1931. The other was caught at Carbon, Alberta, 30 miles in an exactly opposite direction, on July 1, 1931. While these two records show an apparent migration, in two different directions, yet we must remember that young owls tend to wander widely after leaving the vicinity of the nest. Still, after this allowance is made, there are many other Montana horned owls that remain much closer home than these two did. Possibly there is a movement south by the most northern birds, just as I observed a movement down from the highest altitudes in the Yellowstone.

Winter.—While I do not think that any number remain all winter in the Yellowstone Park, on one occasion I found where one had caught a pine squirrel on the snow, although the squirrel had attempted to dig down into the snow and escape. On another winter day I found the trail of a snowshoe rabbit ending abruptly where there were prints of an owl's wings on either side. In this case there was no indication that the rabbit had known of the owl's approach, no sign of a struggle, and very little blood. Evidently the rabbit had been seized and carried off before it knew the owl was near. This picking up of its prey is very different from the heavy blows struck at enemies. So far as I know, these heavy blows are not used at prey.

Kelso (1930) says: "During the winter of 1928–29, two Western Horned Owls (*Bubo virginianus pallescens*) were repeatedly observed to be ranging along a cottonwood-bordered creek a few miles east of Aurora, Colorado. In the months of January and February they occupied widely separated parts of their territory, and neither had any regular roosting place." But Wolfe (1912) has recorded: "During the winter of 1909–10, I noticed that a male Western Horned Owl had taken up his home in a large hole in a clay bank which was usually used in the summer by Barn Owls." This hole was 2 feet deep, and in March Mr. Wolfe found a pair of horned owls nesting there.

NYCTEA NYCTEA (Linnaeus)

SNOWY OWL

PLATES 79–83

HABITS

This great white owl, one of the largest and most powerful, enjoys a wide circumpolar distribution throughout the Arctic regions of both hemispheres. It breeds north of the limits of trees on the Arctic tundras as far north as explorers have found suitable land that is not covered with perpetual ice and snow, and where it can find suitable food supply. But it is by no means evenly distributed or universally abundant, nor is it permanently abundant anywhere, on account of the periodic fluctuations in its food supply. At Point Barrow, for example, John Murdoch (1885) says: "Its abundance in the spring and summer near the coast appears to depend on the presence or absence of its favorite food, the Lemming, as has been noted elsewhere by Mr. Nelson. During the season of 1882 we saw no Lemmings, though signs of their presence in the shape of droppings, and their skulls and skeletons in owl's castings, were numerous all over the tundra. During that season we saw but very few owls. On the other hand, in 1883, Lemmings were exceedingly plenty all round the station, and owls were proportionately abundant; scarcely a day passed without one or more being seen sitting on the tundra, generally on the top of a bank or small knoll, on the lookout for Lemmings."

Writing of its distribution in Alaska, Dr. E. W. Nelson (1887) says:

> It is more common in the northern part of the Territory, where its distribution however, is irregular, it being abundant at one season and almost totally unknown the next. I was informed by Captain Smith—a well known whaling captain of that region—that he had seen as many as fifty of these birds perched in view at one time along the abrupt coast-line of the Arctic, in the vicinity of Cape Lisburne, and yet they were so shy that it was impossible to secure a single bird. * * * The natives told me of seasons, separated by long intervals, when the lemmings have occurred in the greatest abundance, and the White Owl accompanied them in such numbers that they were seen dotting the country here and there as they perched upon the scattered knolls.

Theodore Pleske (1928) says of the haunts of this owl on the Eurasian tundra:

> The Snowy Owl during its breeding season inhabits the alpine zone exclusively, that is to say, those parts that are quite bare of any vegetation whatever, either the tops of the mountains (the *tunturi* of Lapland and the Pae-choi) or the plains of the circumpolar tundra. I believe, therefore, that if these plains are quite lacking in dry hillocks or if they chiefly consist of marshy ground, the Snowy Owl does not readily breed in them and seeks more favorable situations for nesting. Evidently these hillocks are absolutely essential for the existence of this bird because they serve it as observation-posts over its hunting grounds.

> For hours at a time the Owls remain quietly perched on the summits of these hillocks, and at a distance look like patches of snow; they likewise make their nests on such hilltops of various origin. It is thus very likely that the lack of hillocks in certain parts of the Eurasian tundra, and not the lack of food, is what causes the Snowy Owls to avoid certain regions as breeding places.

Spring.—After a winter sojourn in southern Canada or the United States, the snowy owls generally leave for the north early in spring, but often a few may linger through spring, or even well into summer. James H. Fleming (1902) says that, after the great invasion of 1901–1902, "during March the females disappeared and were replaced in April by the returning flight of light colored birds (males, as far as I was able to examine). A few remained about Toronto Marsh all through May, and a small light colored male was taken on June 7. It was in excellent condition and showed no trace of being a wounded bird."

Snowy owls generally disappear from Massachusetts in April, but Mr. Forbush (1927) has recorded one as late as May 20. Dr. Glover M. Allen (1903) records one taken near Concord, N. H., on July 15, 1897, and says: "The previous week had been extremely hot, and the bird is conjectured to have lived in a large ice-house near by, upon the cupola of which it was shot." Dr. Harrison F. Lewis, in some notes he sent me on birds of the Labrador Peninsula, says: "Howard H. Cleaves and I saw a snowy owl on Fright Island, in the Mingan Islands, near Havre St. Pierre, on June 4, 1927. Another individual of this species spent the summer in the vicinity of Perroquet Island, in Bradore Bay, where the thousands of nesting puffins and razor-billed auks offered an abundant food supply. This owl was seen frequently by Officer Esdras Carbonneau, who was stationed at this point to protect the sea-bird colonies, and it was seen also on June 28 and August 26 by Mr. Cleaves."

Courtship.—Dr. George M. Sutton (1932) noted what he regarded as a courtship performance on Southampton Island, of which he writes:

> From May 15 to June 20 in the vicinity of the Post I heard Snowy Owls hooting, especially in the morning on the brightest days. The deep booming notes floated across the rosy-white snow-plains from far and near, sometimes from dozens of birds at the same time. The notes had a decidedly ventriloquial quality, so that they seemed sometimes to come from high in the air, or from the ground. The air fairly throbbed with dull, thick sounds.
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> On May 25, a beautiful day, at about ten o'clock in the morning, I counted at least twenty booming birds (probably all males) in the region about the Post. So far-carrying were the cries that I could hear also the birds across the harbor, seven miles away. I walked across the ridges back of the Post trying to locate one of the hooting birds. Finally, I found one perched on the top of a boulder, on a low ridge. To see him the better I crawled through the snow. When I got down to hands and knees he began hooting. He lifted his head, swelled out his throat enormously, elevated his tail comically until it stuck almost straight

up, and gave four long, low hoots, bowing violently each time he hooted. Then he dropped his tail, pranced awkwardly with toes widely spread, as if surveying his surroundings for some sign of his mate, and hooted again. Booming voices answered from the ridges far and near. All at once, he spread and lifted his great wings and flew off stiffly.

Nesting.—The most northerly, and probably the first nest of this owl ever recorded, was found by Major Feilden in Grinnell Land, latitude 82° 40′, on June 20, 1876; it is described as "a mere hollow scooped out of the earth and situated on the summit of an eminence which rose from the center of the valley" (Greely, 1888). A similar nest was found by Gen. A. W. Greely, near Fort Conger, Grinnell Land, on May 25, 1882 (Bendire, 1892). Major Bendire (1892) also says: "The nests of the Snowy Owl are ordinarily placed on the ground, usually on the highest and driest point in the surrounding tundra. Occasionally a nesting site on a rocky ledge or a cliff is chosen. In either case the nest is but a flimsy affair at best, consisting, if on the ground, of a slight hollow scratched out by the birds, and this is usually lined with a little moss and a few feathers; if on top of a ledge or a cliff, the eggs frequently lie on the bare rock, with just enough material around them to keep them in place and prevent them from rolling about."

Dr. Sutton (1932) records a number of nests of the snowy owl, found on Southampton Island. One was "on a bare-topped gravel-bank about three miles inland from the frozen harbor"; another was "neatly built in the grass at the end of a rocky rise between two frozen lakes." Of the most interesting nest, he writes:

> I walked along this ridge for half a mile and found no sign of a nest. Furthermore I noticed that the farther I went the less attention the bird seemed to pay to me; so I retraced my steps. The attack was immediately resumed. I turned off to one side to follow the top of one of the lesser ridges. Then the female, a noticeably larger and darker bird, appeared. She flew quietly ahead of me, fell in the snow, and began a series of the most comical antics I ever saw. She lifted her wings, waddled around clumsily, lay down, got up and hobbled off, then lay on her belly with her wings spread on the snow all the while whining in a feeble voice. * * *
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> I walked back and forth again and again, but could not find the nest. I retired and waited for a time hoping the female would return to her eggs, but she only stood on a rock watching me the whole time. When I took up the search again I walked to the end of the farthest of the low spurs which led out from the main ridge, and there, on the very top of the knoll, in a sort of basin in the six-inch snow, actually lying in almost an inch of chill water, were six eggs [pl. 83]. The instant I found the nest the male fell to the ground, joined the female in flopping about with waving wings, and delivered an amazing series of laughing barks, which startled me considerably. Then he flew toward me and almost struck my head. As I photographed the nest the birds made cries which sounded like heavy teeth grinding together.
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> There was but little lining in the nest. During a recent gale much snow had fallen and this had evidently drifted about the sitting female, so that the eggs were surrounded with a distinct rim of snow. The nest was not sheltered by any

sort of rock or shrub. The eggs, which were decidedly soiled, proved to be nearly fresh, and were very palatable.

O. J. Murie (1929) says, of some 40 nests observed near Hooper Bay, Alaska:

> The snowy owl nested most abundantly on the high rolling tundra, but a certain number were found on the tide flats and others on the slopes of the Askinuk Mountains. In nearly all cases the birds chose a hummock for the nesting site. In a few instances a large hummock, rising prominently to a height of three or four feet, was selected, but ordinarily the nest was made on a less conspicuous rise, sometimes a very slight one. Often there were numerous other hummocks in the vicinity, many of them better defined and drier than the one containing the nest. On the high tundra, as well as on the tide flats, small lakes were plentiful, and the nests were consequently located near some body of water or marshy tract, usually on a long gentle slope. They were seldom found on the highest elevations. In the Askinuk Mountains nests were found on various parts of the slopes, one at least at an elevation of approximately 1000 feet. Other nests were seen on the salt-water marsh, which was partly enclosed by two spurs of the mountains.
>
> The nest was merely a hollow scooped out of the top of the mossy knoll or mound, usually exposing the peaty earth underneath the vegetation. Normally there was no lining, but in a few instances moss, lichens, or grass was present in the nest. This had been plucked near the nest rim. One nest had been made on a small mound capped with tall grass. The owls had torn out enough of the grass to make room for the nest and had left the rest standing.
>
> In the Askinuk Range, three nests were found on huge granite boulders about four feet high and capped with moss and other vegetation in which the nest cavities had been scooped out. One nest was near the base of a slope, the other two at a much higher elevation on the upper slopes. Sometimes a second nest was found near the one occupied. One such nest consisted of a well-formed cavity; another had been started only. These were evidently false beginnings, abandoned when the owls had decided on a new location.

Capt. J. H. McNeile has sent me some notes on his experience with the nesting of the snowy owl in Swedish Lapland, and also some excellent photographs of the nests and their surroundings; I quote from his notes for June 7, 1924, as follows:

"When we topped the ridge, we found ourselves looking down over a great stretch of undulating snow, with here and there a rocky crest or hillock standing out as an isolated patch of black, and with all the surrounding mountains and distances blotted out by the powdery snow which was driving in our faces. Even the reindeer had not attempted to go up there, as the snow was lying too deep everywhere, and the only living creatures to be seen were an occasional ptarmigan or golden plover, and a pair of rough-legged buzzards whose melancholy cries made the dreary scene appear even more dismal.

"The three of us separated, so as to try to hunt the black hummocks or small bare hillocks as systematically as possible, and for five hours or more we toiled and struggled over that abominable soft snow, and never saw a sign of a snowy owl. But luckily, at about 10 p. m., we heard a shout from Johan, a mile away to the east of us, and found he had got a snowy owl's nest with four eggs. It was merely a scrape in the top of just such a little rocky eminence as we had been expecting to find it on, and there were a few feathers half-buried in the lichens and fresh snow close round about the nest" (pl. 79).

Eggs.—The snowy owl ordinarily lays five to seven or eight eggs, but sometimes as few as three or four, and as many as 13 have been found in a nest. The eggs are like other owls' eggs, but they are often more elongated, to oblong-ovate. The shell is somewhat roughly granulated and without gloss. The color is pure white or creamy white. Bendire (1892) says: "A few corrugated lines starting a trifle beyond the center of the egg and running to the longer axis are noticeable in the majority of specimens examined by me." The measurements of 56 eggs average 56.4 by 44.8 millimeters; the eggs showing the four extremes measure **60.5** by 47, 58 by **47.5**, and **50.6** by **41.7** millimeters.

Young.—Dr. Pleske (1928) says that "the duration of incubation of the eggs of the Snowy Owl has been determined in the aviary of Fontaine as between 30 and 34, with an average of 33 days." He refers to a set that "was found at Kotelny Island, 24 June 1902, and contained two nestlings and eight eggs. It was collected 6 July 1902, and then consisted of nine nestlings of very different sizes and a single egg, from which the young was on the point of hatching. During this period of twelve days seven young had thus hatched out, which gives us an average of 41 hours between the hatching of each young bird."

From the foregoing facts he has figured out a table showing the approximate hatching time of each young bird, which shows "that precisely at the moment of hatching of the last young of the set, the first one had reached the age of 356 hours, that is, 15 days and 9 hours." He quotes Professor Collett as follows: "As in all birds of prey the Snowy Owl does not lay its eggs one after another at brief intervals but over an extended period and at irregular intervals, so that by the time that one egg is laid, incubation will already have begun with those laid earlier. * * * The young one hatched from the first egg should thus be almost completely fledged by the time the last one is hatched. So the young covered with thick down may evidently share in covering the remaining eggs, for the parents are quite busy enough with the care of raising the young which in part are already half grown and require a considerable amount of food."

Dr. Sutton (1932) says:

> The female alone incubates, while the male defends the nest, and feeds his mate. The period of incubation was found to be about thirty-seven or thirty-eight days. * * *
>
> The small young are fed on mice and small birds, especially the young of shorebirds, longspurs, and buntings; and at this time of the year the owls probably destroy more small birds than at any other season.

> * * * The young, which are helpless at first, are downy white. They slowly become strong enough to stand, and, when they find themselves able to crawl about, they wander among the rocks and grass. * * * With the coming of the fall and winter the family-groups break up, as the individuals seek good hunting-grounds, but the parents may remain together more or less throughout the winter.

Mr. Murie (1929) writes:

> As nearly as could be determined the incubation period is about 32 days. * * * When the young were hatched it was the female that fed them, although the male probably furnished the food. Her face and breast were usually bloody and bedraggled as a result of her duties at the nest, while the male's plumage was clean. * * * The longer the nest was occupied the wider and flatter became the cavity. As the young hatched and grew the nest became littered with mouse fur, bird bones, and feathers (including owl feathers). Thus the nest with this accumulation in many cases became a mere platform for the young until they were old enough to scramble out and crouch in the grass near by. * * * I was surprised to find a high mortality among the young. Most of the broods numbering 7 or 8 were eventually reduced to 4 or 5, while some were still further decimated. The factors involved are hard to determine, but a number of observations were suggestive. By the middle of July rains had set in and prevailed during the remainder of the season. During the rainy spells I found downy young, in the gray plumage, crouching in the grass, wet and bedraggled. They leave the nest when old enough to scramble about easily and can not then be sheltered by the parents. On July 6, in one nest that had been under observation, only one live bird remained and near-by lay two others, dead. On July 15 at another nest the youngest owlet, soaked by rain, was dying. In the first instance feathers of a jaeger (probably *Stercorarius parasiticus*) were scattered near the nest. The owl may have killed one for food, but it is also possible that the jaeger had attempted to rifle the nest in the owner's absence and had been caught redhanded. Earlier in the season, on May 29, a nest was robbed by jaegers. One egg had been eaten and two or three others punctured, leaving an imprint of the jaeger's bill. No doubt the robbery had been interrupted by one of the parents.

Plumages.—When first hatched, and probably for the first eight or ten days, the youngest owlets are covered with pure white down. But they soon begin to lose their snowy appearance, as the white down begins to be pushed out and replaced with dark, gray down, thick, long, and fluffy, especially on the flanks and thighs; this is "hair brown" to "drab" and carries on its tips for some time the remains of the primary white down, which gradually wears away. Before these tips have entirely disappeared, the first winter plumage begins to appear in circles of white feathers around the eyes, and on the bend of the wing; the wing quills burst their sheaths at this time, and then follows a general spread of white plumage on the face and wings and, later, on the body, concealing the gray down.

In their first winter plumage, which is worn until the first postnuptial molt the following summer, the young birds are much more heavily barred everywhere, than adults of the same sex, with "olive-brown" to "clove brown"; early in the season, at least, and perhaps later, there is more or less of the drab juvenal down concealed under the feathers, especially around the neck, in birds of the year.

Adult males are considerably smaller than adult females and much whiter; the sexes can generally be recognized in life, as the females are usually much more heavily barred, except on the face and throat, than males. The darkest males and the lightest females are much alike in color, but the whitest birds, sometimes practically pure white, are always males; and the most heavily barred birds are always females. Adults have one complete annual molt, beginning in July and lasting into the early fall.

Dr. Nelson (1887) refers to a highly plumaged male as follows: "On one occasion, while traveling south of the Yukon in December, I secured a beautiful specimen of this bird, which was nearly immaculate-milky white, with a rich and extremely beautiful shade of clear lemon-yellow suffusing the entire bird, exactly as the rosy blush clothes the entire plumage of some gulls in spring. The bird was kept until the next morning; an examination then showed that [the] beautiful tinge had vanished and the feathers had become dead white, with barely a trace of the coloring seen the previous evening."

Food.—Nearly all observers agree that in its Arctic summer home the main food supply of the snowy owl consists of lemmings and other small rodents, when these little animals are abundant; but during the periods of scarcity of lemmings and mice, which happens frequently, the owls must move or find some other food supply; and, during their periodic invasions of more southern regions, they have to subsist on whatever forms of animal life they can find.

Besides lemmings and various species of mice, these owls have been known to kill and eat hares, rabbits, ground squirrels, rats, moles, and shrews. When hard pressed for food, they will eat whatever dead animals or birds they can find, or will attack animals caught in traps.

A. L. V. Manniche (1910) writes:

> I often observed owls and hares sitting close to each other showing no sign of hostility. On a certain occasion quite the reverse seemed however to be the case.
>
> One day in October I had for a while observed a Snowy Owl—an unusally big and dark coloured bird—which had settled on a block of stone on the lowest slope of a large rock.
>
> After three hours I approached the owl, which at last—as it seemed—very reluctantly left its seat only to settle again soon after on another rock a little higher up the fell.
>
> I judged from the behaviour of the bird, that something unusual had attracted its attention and went to the spot, where the bird had been sitting, in order to examine the place.
>
> Two Alpine Hares were sitting in a sort of cavern made by blocks of stones rolled down; they proved very frightened and could hardly be driven off. At last I chased the hares out of their shelter whereupon they sat watching and nervously striking the ground with their hind legs till they soon after with surprising rapidity rushed back to the cavern. It seems evident to me, that the fright of

the hares was caused by the owl, which had certainly made an attack on them, and was now sitting awaiting their return from the cave. * * *

In the dusk and by night, when the Lemmings venture to go farther around, the Snowy Owl will hunt them, flying Kestrel-like and keeping itself on flapping wings over a certain spot before it strikes.

Dr. Nelson (1887) says:

The Eskimo are well acquainted with these birds and with their habits, and one man told me he had seen these owls catch the large Arctic hare by planting one foot in the hare's back and stretching the other foot back and dragging its claws on the snow and ground; at the same time the bird used its wings to hold back, by reversed strokes, until the hare soon became exhausted, when it was easily killed.

On the Lower Mackenzie, Richardson relates that one of the Hudson's Bay Company's Factors, Mr. McPherson, saw one of these owls fly over a cliff and carry off a full fledged Duck Hawk in its claws. It crossed the river to the farther bank, where it lit on the shore to devour its prey. The parent hawk followed, uttering loud screams, and, darting down with great rapidity, killed the owl with a single stroke, but whether with wing or claw could not be determined. After this summary act of vengeance the falcon returned to its nest.

This owl also preys upon ducks, as Stejneger saw it pursue sea ducks on the reefs of Bering Island.

The snowy owl has been known to kill a number of species of birds, the principal items being tender small birds to feed its young, and ptarmigans and water birds in winter, when mammal food is not so easy to obtain. The list includes grebes, small gulls, various sea birds, ducks, young geese, coots, various shorebirds, ptarmigans and other grouse, and small passerine birds.

Mr. Murie (1929) says:

The food of the snowy owl varied with the character of the nesting ground. Those on the marsh in the immediate vicinity of great numbers of nesting waterbirds fed extensively on birds, both old and young. Others, nesting on drier ground farther from the concentration of waterfowl, maintained throughout the season a diet consisting almost exclusively of mice. In marshy areas remains of young emperor geese and cackling geese and adult old-squaws, eiders, and other ducks, were found. * * * A pair of emperor geese built their nest in the margin of a pond, not more than 50 yards from the nest of a pair of snowy owls. One goose incubated the eggs, and I frequently saw its mate swimming near by. A pair of glaucous gulls nested on an island in the same pond. The owls evidently did not molest them. The geese hatched out their young and left the vicinity, after which I did not have them under observation.

Frank Dufresne (1922) writes:

Their food during the nesting period consisted mainly of moles and ground squirrels with only an occasional ptarmigan, curlew or plover. However, I observed that at this time the female ptarmigan were setting, perfectly concealed, and that the male bird lay quietly close by. It was apparent, therefore, that the more active rodents were more conspicuous and suffered thereby.

As soon as the young ptarmigan hatched my observations of the snowy owl became a record of slaughter. I had no way of telling exactly how many were eaten on account of the softness of the bones, but I do know that rodent regurgitations practically ceased at this time. Ptarmigan, both old and young, became

> the mainstay of the seven pairs of owls and their combined families which I had under observation. I destroyed six of the nests, procuring both old birds in each instance, but I decided to watch the seventh nest to the bitter end, hoping to see a reversion to the rodent diet, but it was useless. After the first hatching of ptarmigan it was but seldom I found rodent signs about the nest. Game birds, instead, by the score went to satisfy the lust of these perpetual hunters. * * *
>
> I estimate carefully and with no wish to exaggerate that a single snowy owl will destroy three hundred game birds in a year. The average conception among the hunters is that it is twice that many, and they may be right. I, myself, have seen one bird kill three full grown ptarmigan within an hour.

Frank L. Farley has sent me the following note: "On April 25, 1931, when driving with C. L. Broly, of Winnipeg, in the vicinity of Rosser, Manitoba, a snowy owl, carrying a crow in its claws, appeared from the rear, and cut across the road immediately in front of the car. It alighted in a field near a fence post and at once commenced to eat its prey. No sooner had he taken his position than a number of crows, estimated at about 30, came flying in from the same direction as that from which the owl appeared and formed a circle around the owl. For a minute or two there was a noisy commotion, with a stretching of necks, but none of the crows dared approach the owl nearer than 10 or 12 feet. The racket kept up for a few minutes, after which the crows left the scene in twos and threes. Some of them headed for woods as far distant as two miles."

W. Sprague Brooks (1915) says: "Practically all the Short-eared Owls I trapped were eaten immediately by Snowy Owls so keen is their sight."

William Brewster (1925) writes: "In mid-winter, about the year 1850, according to my notes, a man named Abbott, living not far from the post office on Upton Hill, surprised a Snowy Owl in the act of killing a hen *directly under his barn*, and dispatched it with a club, for instead of attempting to escape, it faced him boldly, and refused to relinquish its prize. It must have been hard pressed by hunger to behave thus rashly."

Bernhard Hantzsch (1929) says: "They also catch fish and other small marine animals, where water places remain open, but are otherwise satisfied with every possible animal matter, even bits of meat refuse near human dwellings. In general, they seem to get along quite well, since they are almost always fat. Therefore they are hunted by the Eskimos and eaten not unwillingly."

Audubon (1840) describes their method of catching fish as follows:

> While watching for their prey on the borders of the "pots," they invariably lay flat on the rock, with the body placed lengthwise along the border of the hole, the head also laid down, but turned towards the water. One might have supposed the bird sound asleep, as it would remain in the same position until a good opportunity of securing a fish occurred, which I believe was never missed; for, as the latter unwittingly rose to the surface, near the edge, that instant the

> Owl thrust out the foot next the water, and, with the quickness of lightning, seized it, and drew it out. The Owl then removed to the distance of a few yards, devoured its prey, and returned to the same hole; or, if it had not perceived any more fish, flew only a few yards over the many pots there, marked one, and alighted at a little distance from it. It then squatted, moved slowly towards the edge, and lay as before watching for an opportunity. Whenever a fish of any size was hooked, as I may say, the Owl struck the other foot also into it, and flew off with it to a considerable distance.

From the foregoing statements it can readily be seen that the economic status of the snowy owl depends on circumstances. It is a voracious feeder, a powerful killer, and is very prolific, raising large broods of hungry young that require a large quantity of animal food. It can be a powerful force for good or evil. Where rodents are plentiful, it can do much good by keeping them in check; but, where owls are breeding abundantly, they can do a vast amount of damage to game birds, as shown by Mr. Dufresne (1922).

Behavior.—The flight of the snowy owl is strong, steady, and direct but not rapid, as I have seen it. The long, downward stroke of the large wings is a rather deliberate, long sweep; but the upward stroke is quick and rather jerky; it often sails on horizontal wings for some distance, especially as it sweeps upward to alight on some eminence. I have found it always very shy; I have not been able to get nearer to one than 75 or 100 yards; when with us, in winter, it is generally seen perched in some commanding position, on a prominent rock, the top of a high bank or sand dune, or even on the roof of a building, where I have twice seen it; it has been known to perch on a tree, but this is a very rare occurrence. In any such position it has a good outlook and is always on the alert, turning its head from side to side, scanning the surroundings with its great yellow eyes, looking for possible prey, or for approaching enemies; before the hunter comes within long gunshot range, it spreads its great wings and gracefully sails away to alight again at a safe distance; to chase such a watchful bird in the open places it frequents is almost hopeless, for unless one can get a shot at it at short range, its heavy plumage and dense under down will resist anything but the heaviest shot.

Several observers have referred to the shyness of this owl, even in its far northern home, where human enemies are not common. Dr. Nelson (1887) says: "North of Hudson Straits Kumlien found Snowy Owls rather scarce during the winter, and saw them hunting during the day, but notes their excessive shyness. This shyness appears to be characteristic of the bird throughout its northern range, and even upon the lonely and almost unknown Wrangel Island, where, upon our landing, one of these birds was seen, it arose and hastily left for the interior, although we were about 200 yards from it when it first caught sight of us."

The snowy owl is reported as being quite aggressive in its attacks on intruders near its nest. Dr. Sutton (1932) says that, as he approached a nest—

> The owl came straight toward me from the adjacent ridge, until he was about thirty yards away. Here he abruptly turned and circled, hooting angrily. As he flew he sank forward heavily after every wing stroke, then righted himself with the downward beat of his wings, looking back oddly as he flew past, never taking his narrowed eyes from me. I looked all over the ridge crest, but found only tracks in the snow and a few loose feathers. Occasionally when I took my eyes from the circling bird he suddenly flew down at me and I could hear the rush of his great wings and the sullen snapping of his beak not far above my head. It was thrilling to look into his glaring golden eyes, but I found myself hoping that he would not strike me with his talons, which hung down menacingly.

Hantzsch (1929) says: "On 16th October, while I was looking at some *Actodromus fuscicollis* [White-rumped Sandpiper] with the glass on the beach at Hebron, I suddenly heard directly behind me a strong rushing of wings and a deep, angry *Krohgogogok*, almost like a raven, but not quite so hoarse. Turning about I espied a Snowy Owl which had attacked me, flew quickly about me a few more times with remarkably rapid jerking motions of the wings and at the same time uttering its note. But when I pointed the gun at it, it disappeared quickly behind the hills."

Alfred M. Bailey (1926) says that, while he was approaching a nest containing young, "the old male, a fine white specimen, kept circling overhead, occasionally making a hoarse 'who-who'. He would sail up against the wind, then circling, would dart within a few feet of us, paying special attention to my Airedale. He once struck the dog with his talons, causing the bewildered Jerry to drop to the ground with a bleeding ear. The speed with which the owl could drop from the sky on folded wings was a revelation, and time and again I found myself dodging from his fierce onslaught."

Voice.—Already mentioned above are the "deep, angry *Krohgogogok*, almost like a raven, but not quite so hoarse" (Hantzsch, 1929), and the "hoarse *who-who*" (Bailey, 1926). Mrs. Celia Thaxter (1875) says: "I have never heard them cry like other owls; when disturbed or angry, they make a sound like a watchman's rattle, very loud and harsh, or they whistle with intense shrillness, like a human being." And Nuttall (1832) writes: "His loud, hollow, barking growl, *whowh, whowh, whowh, hah, hah, hah* (these latter syllables with the usual quivering sound of the Owl), and other more dismal cries, sound like the unearthly ban of Cerberus; and heard amidst a region of cheerless solitude, his lonely and terrific voice augments rather than relieves the horrors of the scene."

Field marks.—The snowy owl could hardly be mistaken for anything else. The color pattern of the white gyrfalcon, which might be seen under similar circumstances, is much like it, but the shapes of the two birds are entirely different; the falcon's wings are sharply pointed, its head is smaller, and it is slenderer in every way. There is no other large white bird so heavily built, with such a large rounded head, and such broad white wings as the snowy owl.

Enemies.—As with most birds of prey, the chief enemy of this owl is man; it is so conspicuous in the open country that it frequents, while with us in winter, that it is relentlessly pursued, as a handsome trophy to have mounted; it is one of the most popular ornaments for store windows and barrooms. Fortunately it is so shy and so hard to kill that many escape.

Dr. Sutton (1932) says: "The natural enemies of the Snowy Owl are chiefly the Arctic Fox, which steals eggs and young, whenever it can, and the Eskimos, who not only shoot *Ookpikjuak* for food, but who catch them in traps and gather their eggs in the early spring. About the Post the Husky dogs broke up several nests of Snowy Owls. * * *

"On February 8 Jack Ford witnessed a remarkable combat between a trapped fox and an owl. The great bird swooped and dashed at the unfortunate animal and tore its face open with its savage beak and claws. The fox was nearly dead when Jack reached the spot."

A. M. Bailey (1926) says that "Mr. Brower saw two Pomarine Jaegers kill a Snowy Owl this season near her nest. The jaegers swooped upon the flying bird forcing her to the ground and then, with repeated onslaughts from the wing, finally killed the owl."

Winter.—Although some snowy owls remain all winter in their far northern breeding range as long as they can find sufficient food, there is a general southward movement in fall, which includes a majority of the birds.

A. L. V. Manniche (1910) says that, in northeast Greenland, "the Snowy Owls appeared most numerously on their autumn migration from the beginning of August till the middle of October."

Ruthven Deane (1902) quotes the following from a letter from Napoleon A. Comeau:

> Migrations of the Snowy Owl occur almost every year along the north shore of the St. Lawrence River. * * * An abundant food supply seems to be the cause. They generally follow in the track of migration of other birds on which they prey. These are Willow Ptarmigan, the Lesser Auk, and the Murre (*Uria lomvia*). The big migration of 1876, which you noticed, followed a very large migration of Ptarmigans. During the present winter they have followed on an immense migration of the Lesser Auk and Murre. Some three hundred or so Snowy Owls have been shot and trapped by residents in this immediate vicinity in a section of about nine miles. I have examined the stomachs of over a hundred and have found invariably the remains of the two species above mentioned. The owls in some cases were nothing but a lump of fat. The migration began here on November 25, 1901, when the first were seen, and has continued at intervals to this date [March 11, 1902]. The last birds are seen generally about the beginning of May, when they disappear entirely. This bird flies and preys by day as well as by

night, but the greatest flights are by night. They follow the coast line, as a rule. In January of this year I saw over a hundred birds in one evening from seven o'clock to 10.30 P. M.

Almost every year there is a noticeable migration of snowy owls into the southern Provinces of Canada during the late fall and winter. And at more or less regular intervals there have been heavy flights, or invasions, of these birds into southern Canada and the United States. These great flights probably occurred during periods of food scarcity in the north. The principal heavy invasions were recorded during the winters of 1876–77, 1882–83, 1889–90, 1892–93, 1896–97, 1901–02, 1905–06, 1917–18, 1926–27, and 1930–31. The big flights occurred at intervals of four or five years, or multiples thereof, which probably coincide with the periodic fluctuations in the abundance of lemmings and Arctic hares. Considerable has been published on many of these flights, giving data on the localities invaded and the large number of birds recorded, based mainly on the records of taxidermists, who skinned, or mounted, a large proportion of the owls captured; but these figures represent, of course, only a small part of the total migration. Space will not permit recording here more than a few facts regarding some of the more important flights.

The migration of 1876–77 seems to have been confined mainly to the eastern part of the country, but during the winter of 1889–90, according to E. S. Cameron (1907), a taxidermist in Mandan, N. Dak., "had five hundred sent to him for preservation." The flight in 1901–02 was recorded as far west as Michigan; and J. H. Fleming (1902) estimated that somewhere between 500 and 1,000 snowy owls were killed in Ontario that winter.

The big flight of 1905–06, one of the most extensive, was fully recorded by Ruthven Deane (1906); he gathered data regarding it from the wide range that it covered, which included all the eastern Provinces of Canada, from Nova Scotia to Manitoba, all six New England States, New York, Pennsylvania, Ohio, Michigan, Wisconsin, Minnesota, South Dakota, Nebraska, Iowa, Missouri, Indiana, and Illinois. Mr. Deane received, during that winter, records of some 800 specimens taken, showing that the flight had been quite general throughout the above region.

The winter of 1926–27 saw what was probably the most extensive and the heaviest flight of snowy owls of which we have any record. It extended as far west as North Dakota and as far south as North Carolina. Dr. Alfred O. Gross (1927), who published a full account of it, "received 2,363 records of Snowy Owls within the borders of the United States", the largest numbers being recorded from Michigan (592) and Maine (589), while only one each was reported from North Dakota, Illinois, and West Virginia. During this flight, and at other times, snowy owls have wandered far out to sea and have alighted on vessels, sometimes as far as 200 or 300 miles from land. Doubtless many have perished thus in heavy storms or thick fogs.

DISTRIBUTION

Range.—Northern parts of the Northern Hemisphere; migration irregular or of the vagrant type.

Breeding range.—In North America the snowy owl breeds **north** to Alaska (Point Hope, Point Barrow, Camden Bay, and probably Demarcation Point); Yukon (Herschel Island); northern Franklin (Cape Kellet, Bay of Mercy, Winter Harbor, Fort Conger, Grinnell Land, and Cape Sheriden); and probably northern Greenland (Thank God Harbor). **East** to probably Greenland (Thank God Harbor, Etah, Umanak, and Frederikshaab); Labrador (Hebron and Okkak); and Quebec (Old Fort Island). **South** to Quebec (Old Fort Island and Fort Chimo); northeastern Manitoba (Fort Churchill); northwestern Keewatin (Ogden Bay); northwestern Mackenzie (Warren Point); and Alaska (Nulato, Hooper Bay, Ugak Bay, and Hall Island). **West** to Alaska (Hall Island, Nome, Cape Prince of Wales, Diomede Islands, and Point Hope).

Winter range.—Occasionally in winter this owl will remain north nearly or quite to the limits of its breeding range, as Alaska (Bethel, Pish River, and Humphrey Point); Franklin (Bay of Mercy, Point Kennedy, and Bellot Strait); and northern Greenland (Bowdoin Bay). On the other hand, it irregularly occurs as far south as the Central United States. In some of the southernmost of these States the records are so numerous that, while still necessarily classified as an irregular visitant, such areas must be included in the winter range.

On this basis, the winter range extends **north** to southern Alaska, (Nushagak); northwestern British Columbia (Bennett); southwestern Mackenzie (Fort Simpson); northeastern Manitoba (Fort Churchill); and southeastern Labrador (Red Bay). **East** to Labrador (Red Bay); southeastern Newfoundland (St. Johns); Nova Scotia (Sable Island, Halifax, and Yarmouth); Maine (Dover, Richmond, and Portland); Massachusetts (Gloucester, Boston, and Chatham); Rhode Island (Newport and Block Island); New York (Amagansett and Montauk Point); and New Jersey (Elizabeth, Princeton, and Cape May). **South** to New Jersey (Cape May); rarely Delaware (Milford); Maryland (Baltimore and Hagerstown); Pennsylvania (Philadelphia and rarely Connellsville); Ohio (Oberlin and Sandusky); Indiana (Richmond and Bloomington); northern Illinois (Danville, Philo, Urbana, and Evanston); Missouri (St. Louis, Saline County, and Jasper County); Kansas (Manhattan and Ellis); Colorado (Denver); rarely southern Idaho (Birch Creek and Meridian); and Oregon (Camp Harney, Burns, and Sheridan). **West** to Oregon (Sheridan and

Netarts); Washington (Westport, Seattle, and Bellingham); British Columbia (Victoria and Chilliwack); and Alaska (Ketchikan, Sitka, and Nushagak).

Migration.—Ornithological history has recorded many invasions of southern latitudes by large numbers of snowy owls. While the species appears to make more or less regular migratory journeys, it has been assumed that these mass movements are caused by a shortage of the lemmings and hares that constitute their normal food in the north. It also has been postulated that few if any of the owls that make the flight south ever return to their northern habitat. Unfortunately, it is true that these fine birds are killed ruthlessly, as witness the heavy flight of 1902 when it was estimated that no less than 1,000 were killed in the general vicinity of Toronto, Ontario. Nevertheless, banding records in the files of the Biological Survey definitely prove that at least some of the migrants not only return to their breeding range but (more surprising) return during subsequent winters to the same area. Many of these owls have been banded at Fairdale, N. Dak., and from this work some 8 or 10 recovery records are available. Birds banded in winter and spring have been recaptured in the same area during the succeeding winter and also after a lapse of two or three years. One, banded in March 1930, was killed at Fort George, Quebec, about September 10, 1932.

Fall migration.—Early dates of fall arrival are: Southern British Columbia—Chilliwack, November 12; Okanagan Landing, November 23. Washington—Walla Walla, November 9; Tacoma, November 10. Oregon—Sheridan, November 30. Montana—Kalispell, October 14; Great Falls, October 16; Tom Minor Basin, Park County, October 26. Idaho—Meridian, November 23. Colorado—Denver, November 22. Manitoba—Winnipeg, September 20; Aweme, September 26; Oak Lake, October 28. North Dakota—Grafton, October 10; Argusville, October 26; Marstonmoor, November 5. South Dakota—Yankton, October 27; Parkston, November 7; Lake Poinsett, November 15. Nebraska—Brunswick, November 21; Omaha, November 22. Minnesota—Minneapolis, October 15; Elk River, October 23. Wisconsin—Delavan, September 22; Shiocton, October 23; Racine, October 26. Iowa—Osage, November 13; Sioux City, November 16; National, November 19. Ontario—Toronto, October 13; Dunnville, October 23; Point Pelee, October 29. Michigan—Sault Ste. Marie, September 26; Palmer, October 7; Detroit, October 29. Ohio—Austinburg, October 23; Mentor, October 25; Sandusky, October 27. Indiana—Fowler, November 4; Mellott, November 4; Washington, November 5. Illinois—Chicago, November 3; Huntley, November 10; Highland Park, November 17. New Brunswick—Grand Manan, October 20. Maine—Cape Neddick Light, October 19; Machias, November 3. Vermont—Vergennes, October 20; Cornwall, November 13. Massachusetts—Amherst, October 12; Cape Ann Light, November 2; Town Creek, November 4. Rhode Island—Newport, November 1; Warren Island, November 9; Woonsocket, November 10. Connecticut—Stamford, September 18; New Haven, October 17; Hartford, November 10. New York—Rochester, October 26; Garden City, October 29; Buffalo, November 1. New Jersey—Jones Island, Cumberland County, October 26; Morristown, November 16; Orange, November 19. Pennsylvania—Towanda, October 25; Philadelphia, October 30. Maryland—Allegany and Garrett Counties, November 25.

Spring migration.—Late dates of spring departure are: Pennsylvania—Erie, April 13. New Jersey—Elizabeth, April 1. New York—Hamburg, March 22; Lockport, March 29; Bronx, April 5. Connecticut—Waterford, March 18; Branford, April 15. Massachusetts—Pittsfield, March 21; Amesbury, April 3; Boston, April 15. Maine—Auburn, March 7; Dover, March 10; Manchester, March 11. New Brunswick—Scotch Lake, March 29. Illinois—Milford, March 10; Park Manor, March 16; Philo, March 19. Indiana—Crawfordsville, March 12; Richmond, March 17; Valparaiso, March 31. Ohio—Chardon, March 1; Scioto River, April 8 (one was taken at Rayland, May 9, 1909). Michigan—Detroit, April 14; Sault Ste. Marie, April 23 (unusually late dates here are June 4, 1922, June 10, 1924, May 21, 1926, and June 8, 1928). Ontario—Kingston, March 18; Sault Ste. Marie, April 2; Toronto, April 6 (unusually late date is June 7, 1902). Iowa—Remsen, March 28; Webb, April 6; Galbraith, April 18. Wisconsin—Berlin, March 1; Racine, March 25; Madison, April 5. Minnesota—Hallock, April 9; Heron Lake, April 15 (unusually late date is Litchfield, June 3, 1890). Nebraska—Ogallala, April 1. South Dakota—Pitrodie, April 7; Aberdeen, April 12. North Dakota—Westhope, April 3; Argusville, April 14; Larimore, April 12. Manitoba—Winnipeg, April 20; Margaret, April 28; Shoal Lake, May 2 (unusually late date is Aweme, May 21, 1923). Saskatchewan—Indian Head, April 20. Colorado—Denver, April 10. Montana—Billings, March 23. Washington—Westport, April 14. Southern British Columbia—Okanagan Landing, March 29.

Casual records.—The snowy owl has been seen or taken on several occasions south of the winter range above outlined. Among these records are the following: Two were shot at Bass Cove, Bermuda, in the autumn of 1843; one was shot on Ireland Island on November 29, 1853; and two were noted (one taken) in the autumn of 1875. One was killed at Fort Pulaski, Ga., on February 8, 1931. In South Carolina there are several indefinite records, some of which date back to the time of Audubon, but one was taken near Winnsboro on November 28, 1908, and one was reported from Chester in December 1886. They were reported as "abundant" at New Bern, N. C., on November 30, 1876; a speciman was collected in Pamlico County on December 4, 1897; one was taken in Granville County on January 7, 1902; and another was recorded from Nash County late in November 1909. One was collected at Mill Creek, Randolph County, W. Va., on January 10, 1927.

According to the Louisiana Department of Conservation, there are two specimen records for that State, one killed at Baton Rouge and the other at Bayou Des Allemands (date of collection not available for either case). One was taken at Bardstown, Ky., in 1810; a second was seen in that area about 1905; while a third was noted at Bowling Green in February 1892.

In Texas one has been recorded from near San Antonio about 1850, and another was shot at Austin during the winter of 1876. In 1896 five were recorded from California, one being taken in the San Francisco Bay area on December 2; another was reported from Chula Vista, San Diego County, during the same month; while about that time three others were noted in Sonoma County. During the last decade of the last century one was "winged" and kept alive as a pet for several years in Santa Cruz County. One specimen was taken December 26, 1908, at Eureka; another was taken at Trinidad on November 17, 1916; while a third was captured about the same date at Mattole.

Egg dates.—Arctic Alaska: 20 records, June 1 to 29; 10 records, June 12 to 24, indicating the height of the season.

Arctic Canada: 10 records, May 25 to June 24; 5 records, June 16 to 21.

Southampton Island: 9 records, May 25 to June 30.

SURNIA ULULA PALLASI Buturlin

SIBERIAN HAWK OWL

HABITS

This bird replaces the European hawk owl, which has stood on our list for many years, as a rare straggler into Alaska. Since the Siberian bird has been described and given a name, as subspecifically distinct from the European bird, it naturally follows that *pallasi* is the race that should occur in Alaska. It is of very rare occurrence, however, as only two records have been reported. The first record is based on a bird, one of three observed, taken by Lucien M. Turner (1886) near St. Michael, Alaska, in October 1876. Mr. Turner writes:

> The first bird of the kind that I saw was brought to me by a native, who obtained it in the bushes near the southeast base of Shaman Mountain, near the Redoubt. An Eskimo dog stole the bird and destroyed it before I could get it away. The second specimen was procured by me. I was ascending a gravelly point of land on the northeast end of the island, when a native who was with me called my attention to the bird, sitting in a clump of rank grass. I had no gun with me; the native assured me that the bird was not vicious. I seized the bird with my

hands; and, while examining it, the soil and grass beneath me gave way, and while attempting to prevent myself from sliding down hill the bird got away from me and flew off. The third example was brought to me by a native. The skin was preserved, but has been lost in some unaccountable manner. * * *

The natives assert that it is a resident and breeds in the vicinity of St. Michael's; also that it is a coast bird, i. e., not going far into the interior; and that it can live a long time in winter without food, as it remains for days in the protection of the holes about the tangled roots of the willow and alder patches.

Evidently Turner's specimen was not permanently lost, for Ridgway (1914) says: "The specimen on which the record was originally based is now before me; and, while it shows as conspicuous white spotting on the pileum as the European and Siberian form, in other characters it seems not to differ from the American bird, and I think it had better be considered an abnormal example of the latter."

In a later footnote he adds: "It is not unlikely that the Alaskan specimen (from St. Michaels) above referred to may belong to the Eastern Siberian form; indeed Hartert thus places it."

The 1931 Check-List adds another record of a bird in the collection of Dr. Louis B. Bishop, from "Bethel Island." There is evidently no such place as Bethel Island. Dr. Bishop writes to me that this bird, a male, was collected by A. H. Twitchell, on November 5, 1914, probably near Bethel, Alaska. He tells me that he has compared this bird with specimens of *ulula*, *caparoch*, and *pallasi* and came to the conclusion that it is "far nearest to the Siberian" race, "but the brown is of a slightly paler shade."

There is a very marked difference between the Old World birds and the American, the European and Siberian races both being much whiter, with much more extensive white spotting on the pileum and nape, and with white predominating on the under parts. But, in the series I have examined, it is difficult to see any great difference between the European and the Siberian races.

Hartert (1920) admits that the difference is very slight; and Ridgway (1914) says: "As to the claims of the bird from northeastern Asia to subspecific rank, I am not able, with the very small series available, to see that it differs from the European bird."

SURNIA ULULA CAPAROCH (Müller)

AMERICAN HAWK OWL

PLATES 84, 85

HABITS

The North American race of this circumpolar species is widely distributed across the continent, breeding throughout the timbered regions of Canada and from Alaska to Newfoundland and wandering in winter into the Northern United States. It is similar to the typical, European race (*S. u. ulula*), "but coloration much darker, the black and brown areas and markings not only darker in color but more extended, the whitish ones correspondingly reduced in extent; pileum with black predominating, and scapulars with the white areas much broken by bands of blackish brown, and barring on under parts denser" (Ridgway, 1914).

Swainson and Richardson (1831) give us the earliest account of the American hawk owl, saying: "This small Owl, which inhabits the Arctic Circle in both continents, belongs to a natural group, that have small heads destitute of tufts, small and imperfect facial disks, auditory openings neither operculated nor much exceeding those of other birds in size, and considerable analogy in their habits to the diurnal birds of prey. * * * It is a common species throughout the fur-countries from Hudson's Bay to the Pacific, and is more frequently killed than any other by the hunters, which may be partly attributed to its boldness and its habit of flying about by day."

A. D. Henderson (1919), writing of the haunts of the hawk owl, which he finds breeding quite commonly near Belvedere, Alberta, says: "To the north lies the great northern forest of poplars, spruce, pine, birch, tamarac, willow, alder, etc., which, broken only by smaller prairies, burns, and muskegs, extends north to the limit of trees. * * * The particular haunt of the Hawk Owl is in the muskegs and here they can usually be found perched on some dead stub watching for prey."

Nesting.—Bendire (1892) writes:

> Mr. W. H. Dall, of the U. S. Coast Survey, found a nest of this species, containing six eggs, on the top of an old birch stub about 15 feet from the ground, near Nulato, Alaska, May 5, 1868. The eggs were lying directly on the rotten wood, and the male was sitting on them. Climbing to the nest, the bird dashed at him and knocked off his cap. * * *
>
> According to Mr. B. R. Ross, it nests occasionally in cliffs, but its usual nesting sites are probably natural cavities in trees, where they are obtainable, but when such are wanting open nests placed on the decayed tops of stumps or among the limbs of thick and bushy conifers are used.

Roderick MacFarlane (1908) says: "This bird is not uncommon in the region of Anderson River, although only four nests were discovered there some forty years ago. They were all built on spruce pine trees at a fairly high height from the ground, and were constructed of small twigs, branches, and lined with dry grasses and moss."

Dr. Joseph Grinnell (1900) found two nests in northern Alaska; of the first, he says: "On April 26th I located a pair of Hawk Owls which by their restlessness indicated a nesting site near by. The nest was finally found, but there were as yet no eggs. It was in the hollow end of a leaning dead spruce stub about ten feet above the ground. The dry rotten-wood chips in the bottom were modelled into a neatly-rounded depression."

Of the other, he writes:

After a half-hour's search through a heavy stretch of timber, I located the bird perched at the tip of a tall live spruce, partly hidden by the foliage. Then I began an inspection of all dead stubs and trees in the vicinity. I had given up hope of finding a nest and had started on, when, by mere chance, I happened to catch sight of a hole in a dead spruce fully 200 yards away. A close approach showed a sitting bird which afterwards proved to be the male. Its tail was protruding at least two inches from the hole, while the bird's head was turned so that it was facing out over its back. When I tapped the tree the bird left the nest, flew off about thirty yards, turned and made for my head like a shot. It planted itself with its full-weight onto my skull, drawing blood from three claw-marks in my scalp. My hat was torn and thrown twelve feet. All this the owl did with scarcely a stop in its headlong swoop. When as far the other side the courageous bird made another dash, and then another, before I had collected enough wits to get in a shot. The female, which was evidently the bird I had first discovered on lookout duty, then made her appearance, but was less vociferous. The nest contained three newly-hatched young and six eggs in various advanced stages of incubation.

A. D. Henderson (1919 and 1925) has found a number of nests of the hawk owl in the muskeg country near Belvedere, Alberta. All his nests were in natural cavities or in enlarged woodpeckers' holes in dead stubs. A nest found on April 1, 1915 (pl. 84) is described as follows:

"The seven eggs were slightly incubated and were in the hollow top of a dead tamarac or spruce stub as shown in the picture. The nest was about ten feet from the ground and hollow about ten inches deep. The eggs rested in a hollow in the crumbled rotten wood at the bottom of the hole. There was no nesting material but this rotten wood and a few feathers."

Of another nest, found on April 4, he says: "The seven eggs could be seen through an old Flicker's hole almost on a level with them. They rested on a few rotten chips and feathers and lay on top of dry moss and grasses with which the old Flicker's nest had been filled up, likely by a squirrel."

One nest was "about forty feet up in the broken top of a tamarac stub"; another "nesting stub was a large leaning balsam poplar about thirty-five feet high, standing near a muskeg"; still another "was evidently an enlarged hole of the Pileated Woodpecker, and is the only instance in which I have seen a nest that was not in the broken top of a stub." He has found this owl nesting in old crows' nests several times.

I have a set of seven eggs in my collection, collected by Samuel Anderson for the Rev. W. W. Perrett, near Island Harbor Bay, Labrador, on May 7, 1914. The nest was in a rotten stump about 5 feet from the ground And there is a set of five eggs in the Thayer collection, taken by E. Herbert Montgomery at Lance au Loup, Labrador, on May 3, 1899. This nest was "a mass of sticks and moss in the top of a dead tree 15 feet from the ground." Both sets of eggs were fresh.

Eggs.—The American hawk owl lays three to seven eggs, the latter number quite frequently, and rarely as many as nine. The eggs vary in shape from oval to elongate-oval, the color is pure white, and the shell is smooth and slightly glossy. They closely resemble the eggs of the short-eared owl. The measurements of 51 eggs average 40.1 by 31.9 millimeters; the eggs showing the four extremes measure **43.3** by 31.2, 40 by **34,** and **36.5** by **30** millimeters.

Young.—The period of incubation does not seem to have been definitely determined; this would be a difficult matter, as the eggs are laid at some intervals, and incubation begins as soon as the first egg is laid. The nest that Dr. Grinnell (1900) found—

> contained three newly-hatched young and six eggs in various advanced stages of incubation. The downy young, although their eyes were still tightly closed and they were very feeble, uttered a continuous wheedling cry, especially if the tree were tapped or they were in any way jarred This could be heard 20 feet away from the base of the tree. The nest cavity was evidently an enlarged woodpecker's hole. The wood was very much decayed and soft, so that it has been an easy matter to enlarge the entrance. The entrance was 14 feet above the snow, and the nest proper was about three inches below that. The cavity was lined with a mixture of feathers and bits of the rotten wood. The feathers were all apparently from the breast of the female parent. The female bird (the male not at all, although he was sitting on the nest when it was found) had the whole breast and abdomen, from the upper end of the breast-bone to the vent, entirely bare of feathers; also on the sides up to the lateral feather tracts, and through these for about one inch on both sides under the wings; also down the inside of the thighs to the knees. This was the most extensive feather divestment I ever saw in any species. The skin of this area was very thick and glandular, emitting a watery fluid on the inside when squeezed, and filled with distended blood vessels and some fat. This is obviously a warmth-producing organ. The feathers removed from it were evidently mostly used in the nest lining.

Although both sexes share the duties of incubation, it is evident from the above that the female does most of it. While one parent is incubating, the other remains on guard in the vicinity to guard the nest most aggressively. And Dr. A. K. Fisher (1893b) says that "after the young leave the nest the family generally remain together until the following spring."

L. L. Snyder (1928) writes: "The notes of the young birds are decidedly like those of the broad-winged hawk, except that the high-pitched, hissing sound ascends slightly towards the end. An adult was observed hunting mice for its flying young along a creek bed at Camp 33. The hissing calls of its four or five young could be heard from as many directions, unquestionable reminders to the parent that they were there, and hungry. The parent, leaving its perch in the open, gently settled for an instant in the grassy edge of the creek and rose with a meadow mouse in its feet. One of the young was quieted, but before the parent could serve the rest, this young one resumed its calling."

Plumages.—I have not seen the downy young of the hawk owl, or any very small young, showing the development of the juvenal plumage. In a half-grown young, in juvenal plumage, the upper parts are largely "snuff brown" or "cinnamon-brown"; the feathers of the crown and hind neck are tipped with pale grayish buff, giving a frosted appearance; the back and scapulars are indistinctly tipped with the same color; the under parts are pale buff, or buffy white, shaded across the chest and barred elsewhere with "Verona brown", or sooty brown; the facial-disk feathers are dull whitish, tipped with black; the thighs and lower abdomen are still downy, pale buff, and faintly barred. Before the young bird is fully grown, late in June or in July, the wings and tail are grown, and the first winter plumage begins to appear on the back and on the sides of the breast; the drab crown, with its gray tips, is about the last of the juvenal plumage to be replaced by the first winter plumage. This is much like the adult plumage, but there is less white spotting on the upper parts, the barring on the under parts is a more reddish brown, and the tail is more broadly tipped with white.

Adults have one complete molt in summer and fall.

Food.—Dr. Fisher (1893b) says: "The food of this Owl varies considerably at different times of the year. In summer it feeds on the smaller mammals, such as mice, lemmings, and ground squirrels as well as insects of various kinds, while in winter, when the snow is deep and its favorite food is hidden, it follows the large flocks of ptarmigans and subsists on them."

Dr. Coues (1874) says: "It feeds chiefly upon the field mice (*Arvicolae*) which swarm in the sphagnous vegetation of arctic lands; also upon small birds, grasshoppers, and other insects."

A. D. Henderson (1919) writes: "On one occasion when loading some hay cocks, which had been left out and snowed under, a Hawk Owl followed us around the meadow looking for mice as the cocks were lifted. Once it perched on the hayrack itself. On another occasion, when driving to Edmonton, I noticed one which had just caught a large white weasel or ermine. I wanted the weasel and tried to scare it into dropping it by shooting, but there was nothing doing and it flew away with its prize."

Elsewhere (1925) he says: "Mice and weasel are the only animals I have seen captured by the Owl, and the former seem to be the source of its principal food supply. I have seen them with portions of varying hare and Sharp-tailed Grouse, but those were probably remnants from the meal of some animal or larger bird of prey." Forbush (1927) says that "it has been seen to kill and carry off a Ruffed Grouse."

Behavior.—The hawk owl has been well named, for in appearance and habits it is said to resemble some of our smaller diurnal birds of prey; its flight is swift and graceful, suggesting that of the hawks; and, when it is perched on the top of some tree or stub, in broad daylight, it has sometimes been mistaken for a hawk. It has also been called the "day owl", because of its conspicuous diurnal habits; it probably hunts more extensively by day than any of our other owls, except, possibly, the short-eared and the pygmy owls. William Brewster (1925) says of one that he watched fly away: "His flight over the Pond was perfectly straight, exceedingly swift, and very graceful. Except when set during brief intervals of gliding, his wings were beaten ceaselessly and rapidly, with much the same nervous, quivering motion as that characteristic of the Duck Hawk. They, with the conspicuously wedge-pointed tail, looked long and shapely as did the body also, doubtless because its contour plumage was compressed by friction with the air. Altogether he seemed a well-proportioned, handsomely-modelled and pleasingly graceful bird when thus viewed in flight, albeit no less displeasingly awkward and ungainly than the first Hawk Owl, while on its perch."

Ernest T. Seton (1890) says: "Its favorite localities appear to be the half-open woods and park lands, and it is usually seen perched on the top of the bushes and trees. In passing from one tree to another, it commonly throws itself headlong downwards nearly to the ground, along which it skims towards the next tree, and on nearing its goal rises with a graceful aërial bound to the topmost perch offered." Quoting from the manuscript of C. W. Nash, he says further: "Its flight, particularly through the low bushes and scrub, closely resembles that of the Sharp-shinned Hawk; it skims along noiselessly close to the ground, frequently alighting on the top of a bush, from whence it will dart on a mouse or other prey. It also frequently rises high in the air and hovers over the ground, remaining stationary over one place for some time, exactly like a kestrel or our own Sparrow Hawk."

The most striking feature in the behavior of the hawk owl is its tameness, boldness, or utter lack of fear, perhaps largely due to its lack of familiarity with human beings. It has repeatedly shown no concern when closely approached and has even been captured by human hands.

Lucien M. Turner (1886) writes: "I once observed a bird of this species sitting, during a bright day, on a post. I approached the bird to within a few feet. It squatted, then stood up, and seemed ready to fly at any moment. I went within six feet of it, and it then settled down as if to take a nap. I retired and threw a stick at it to make it fly. I shouted and made other noises, and only after several attempts to dislodge it did it fly."

Baird, Brewer, and Ridgway (1905) say:

> Mr. Dresser, who had ample opportunities of observing the Hawk Owl in New Brunswick, where he found it by no means uncommon, describes it as a true day Owl. It was often seen by him hawking after prey in the strongest sunshine, or seated quietly blinking on the top of an old blasted tree, apparently undisturbed by the glare of the sun. In its general appearance and particularly in its flight, it appeared to him to have considerable affinity to the Sparrow Hawk. In New Brunswick it affected the open plains or so called blue berry barrens, where the open country is covered with low bushes and an occasional scathed tree. It would sit on one of these trees for hours in an upright hawk-like position, occasionally hunting over the ground, like the Kestrel of Europe, in search of small field-mice. It showed but little fear, and could easily be approached within gun-shot. When shot at and missed, it would take a short flight and return to its former perch. On one occasion, Mr. Dresser, firing at one with a rifle, cut the branch close under the bird, which returned almost immediately to another branch, was a second time missed, and finally fell under a third shot.

The experience of Dr. Dall and Dr. Grinnell, related above, and the following account by Mr. Henderson (1919) all show that the hawk owl can put up a vigorous fight in defense of its nest: "As I climbed the stub she charged and knocked my heavy Stetson hat off and struck me several times on top the head and quite hard. Once she put her claws through my shirt and scratched the skin. I had to watch her continually and wave her off when she charged, always straight at my head, as I was cutting out the side of the stub to get a picture of the nest and eggs. The mate appeared on the scene soon after I commenced work, but did not attack like the other."

Voice.—Mr. Henderson (1925) says: "The calls of this Owl are a trilling whistle, *wita-wita-wita*, etc., which is the love call of the male. I have never heard it uttered by the female. It is one of the signs of early spring, being first heard in February and through March and April. Other calls are *squee-rick* or *quee-ick*, *wike* or *rike*, and *wherr-u*."

Lee Raymond Dice (1920) writes: "Notes and calls are numerous and quite varied, but all seem quite musical. *Kr-r-r-r-e-e-eep*, a low rapid rattle rising to a cry is often heard. *Wur-a-wur-a* (rapid) and *kuk-a-wuk* (very low) were given by a male on March 25 while he was seated in a dead spruce."

C. B. Horsbrugh (1915) says: "My specimen gives voice to a melodious *wheup, oop, oop, oop, oop, oop*, generally at dusk." And Mr. Seton (1890) says that "it sometimes utters a rolling *whill-ill-ill-ill-loo*, somewhat like the cries of the Long-eared Owl." It seems to be a versatile vocalist.

Field marks.—The hawk owl is a medium-sized owl, with a rounded head, without ear tufts, and with a long, graduated tail, which it often jerks up and down while perched and sometimes holds it up at an angle. It is very dark above and transversely barred across the breast and abdomen. In flight it resembles the falcons, and shows rather short, pointed wings. It often sits with its body inclined forward, or sits upright like other owls.

Winter.—Hawk owls usually spend the winter well within their breeding range, even as far north as Alaska and the fur countries. But, on rare occasions, shortage in the northern food supply forces large flights of these owls southward for a limited distance. One such memorable flight occurred in 1884, of which William Brewster (1885) writes:

> Although the months of October and November, 1884, do not seem to have been characterized by any special meteorological phenomena, they will be long remembered by ornithologists and collectors throughout Northern New England from the fact that they brought to this region a flight of Hawk Owls altogether unparalleled in any previous year of which we have definite records. The inroad seems to have begun late in October and to have lasted nearly through November. It apparently extended over most of Northern Maine and New Hamsphire, but I have no evidence that it reached Massachusetts. Some idea of the abundance of the birds may be had from the fact (for which I am indebted to Mr. Manly Hardy) that a single taxidermist in Bangor, Maine (Mr. Bowler), received no less than twenty-eight freshly-killed specimens in the course of a few weeks. Most of our Boston taxidermists also had from three to six each (all from Northern Maine or New Hampshire), and at Lake Umbagog, Oxford County, Maine, I secured four, shot respectively Oct. 25, Oct. 31, Nov. 15, Nov. 16.
>
> These figures doubtless represent but a small proportion of the total number killed, for in the region over which the birds spread few persons are aware that an Owl has any commercial value, although every one shoots the despised bird at sight. Thus for every one preserved a dozen were probably thrown away. As instancing this, I quote the following from a short note in 'Forest and Stream', signed Ned Norton, and dated at Colebrooke, N. H., Dec. 1:—'Hawk Owls came three weeks ago in greater numbers than ever seen before. Farmers' sons have been killing them all over the country.'

Frank L. Farley writes to me, from Camrose, Alberta: "The hawk owl has become exceedingly rare during the past 25 years. The winter of 1896–97 witnessed a real invasion of these owls into central Alberta, when in one day's drive I counted as many as 30 of the birds as they hunted over the prairie, or perched on the tops of trees and haystacks watching for mice."

DISTRIBUTION

Range.—The northern parts of North America.

Breeding range.—The American hawk owl breeds **north** to Alaska (Jade Mountains, Bettles, Coldfoot, and Fort Yukon); Yukon (La Pierre House); Mackenzie (Fort Good Hope, Fort Anderson, and Lake Hardisty); northern Saskatchewan (Fond du Lac); probably northern Manitoba (Lake Du Brochet); northern Quebec (Fort Chimo and Whale River); and Labrador (Okak). **East** to Labrador (Okak and Nain); probably Newfoundland (Nicholsville); and southern Quebec (Lochaber). **South** to southern Quebec (Lochaber); Ontario (Lake Temiskaming, probably Cochrane, and probably St. Ignace Island); northern Michigan (Isle Royale); probably northern

Minnesota (Cook County, Koochiching County, Roseau County, and Norman County); east-central Saskatchewan (Hudson Bay Junction); central Alberta (Glenevis and Jasper House); possibly Montana (Madison River and Summit); possibly northern Idaho (Stanley Butte); British Columbia (probably Laurier Pass, Rapid River, McDame, Quartz Creek, and Atlin); southwestern Yukon (near Whitehorse); and southwestern Alaska (Lake Clark and probably Chulitna River). **West** to Alaska (probably Chulitna River, Russian Mission, Kotlik, Nulato, Nome River, and Jade Mountains).

Winter range.—At this season the hawk owl has been recorded **north** to Alaska (Bethel, Toklat River, and rarely Fort Yukon); rarely Mackenzie (Fort Confidence); Manitoba (rarely Grand Rapids, Kalevala, and Winnipeg); northern Ontario (Martin Falls); Quebec (rarely Lake Mistassini and Godbout); and Labrador (Cartwright). **East** to Labrador (Cartwright); rarely New Brunswick (Scotch Lake); rarely Maine (Bangor); and rarely Massachusetts (Salem, Lynn, Brookline, Sandwich, and Chatham). **South** to rarely Massachusetts (Chatham); rarely Rhode Island (West Greenwich Center); rarely Connecticut (New Haven); rarely Long Island (Bayridge); rarely New Jersey (Middlesex and Mercer County); rarely western New York (Conquest and Rochester); rarely southern Ontario (Toronto and Mount Forest); rarely southern Michigan (Port Huron and Detroit); rarely Wisconsin (Lake Koshkonong and Meridian); Minnesota (St. Paul, Elk River, and Marshall County); northeastern North Dakota (Joliette and Grafton); Montana (Summit, Nyack, Kalispell, and Fortine); rarely Washington (Martin); and southern British Columbia (Victoria). **West** to British Columbia (Victoria) and Alaska (Nushagak and Bethel). As will be surmised from this outline, the hawk owl is irregular in the southern parts of the winter range and not infrequently it is entirely unobserved over periods of several years.

Migration.—This species is not regularly migratory, and but little is known of its movements. Occasionally it will appear in regions south of its breeding range in relatively large numbers, as during the winter of 1884, when a notable flight visited New England. It also was fairly common in 1922–23.

Fall migration.—Some early dates of fall arrival are: Nova Scotia—Sable Island, October 9. Maine—Machias, October 27; Bangor, October 28. New Hampshire—Lake Umbagog, October 25. Vermont—Cornwall, November 2; Derby, November 11. Massachusetts—Middleboro, November 29. Ontario—Ottawa, October 9; Toronto, October 18. Michigan—Sault Ste. Marie, September 27. Minnesota—Itasca Park, September 15; Roseau County, September 25.

Spring migration.—Some late dates of spring departure are: Minnesota—St. Paul, May 21 (unusually late). Michigan—Sault Ste.

Marie, April 29. Ontario—Ottawa, April 5 (unusually late, May 5). Massachusetts—Sandwich, March 25. Vermont—Wells River, March 4. New Hampshire—Colebrook, April 20. Maine—Van Buren, April 16.

Casual records.—According to Reid (1884) one was "seen" at St. George, Bermuda, date unknown. This record is considered doubtful. On three different occasions (December 26, 1884, March 10, 1885, and January 28, 1886) the hawk owl was reported from Mount Carmel, Audrain County, Mo., but as no specimen from that State is known, these observations also must be considered doubtful.

One was shot at Raymond, Nebr., in November 1891; there are a few records for northern Illinois, and one was captured near Oberlin, Ohio, about 1880. Other records for Ohio, as well as one for Indiana, are considered unsatisfactory. Several hawk owls, collected in the British Isles, have been identified as the American form.

A closely related subspecies, the Siberian hawk owl, *Surnia ulula pallasi,* is found in eastern Siberia. Two specimens collected in Alaska, one at St. Michael, in October 1876, and the other at Bethel in November have been identified as of this race.

Egg dates.—Alaska and Arctic Canada: 10 records, April 28 to June 14; 5 records, May 4 to 17, indicating the height of the season.

Alberta: 38 records, April 1 to June 4; 19 records, April 13 to 28.

Labrador and Newfoundland: 6 records, May 3 to June 20.

SPEOTYTO CUNICULARIA HYPUGAEA (Bonaparte)

WESTERN BURROWING OWL

PLATES 86, 87

HABITS

On the wide, open, treeless plains and prairies, west of the Mississippi Valley, and from southern Canada south into Mexico, this curious little owl is, or was, widely distributed even as far west as the Pacific States. It loves the virgin prairies and the unbroken plains but does not take kindly to cultivated land; consequently the encroachments of agriculture have greatly restricted its former range; it is now found ordinarily only in the few scattered places where primitive conditions still remain, untouched by the hand of man.

Much foolish nonsense has been broadcast by careless observers, or romancers, about the home life of these birds and their happy family relations with prairie dogs and rattlesnakes. No intelligent naturalist now believes any such fantastic stories as have been told, and perhaps believed by some. Dr. Elliott Coues (1874) has explained the basis for these yarns, and given us the actual facts, in the following well chosen words:

First, as to the reptiles, it may be observed that they are like other rattlesnakes, dangerous, venomous creatures; they have no business in the burrows, and are after no good when they do enter. They wriggle into the holes, partly because there is no other place for them to crawl into on the bare, flat plain, and partly in search of Owls' eggs, Owlets, and puppies, to eat. Next, the Owls themselves are simply attracted to the villages of the prairie-dogs as the most convenient places for shelter and nidification, where they find eligible ready-made burrows, and are spared the trouble of digging for themselves. Community of interest makes them gregarious to an extent unusual among rapacious birds; while the exigencies of life on the plains cast their lot with the rodents. That the Owls live at ease in the settlements, and on familiar terms with their four-footed neighbors, is an undoubted fact; but that they inhabit the same burrows, or have any intimate domestic relations, is quite another thing. It is no proof that the quadruped and the birds live together, that they are often seen to scuttle at each other's heels into the same hole when alarmed; for in such a case the two simply seek the nearest shelter, independently of each other. The probability is, that young dogs often furnish a meal to the Owls, and that, in return, the latter are often robbed of their eggs; while certainly the young of both, and the Owls' eggs, are eaten by the snakes. In the larger settlements there are thousands upon thousands of burrows, many occupied by the dogs, but more, perhaps, vacant. These latter are the homes of the Owls. * * * It is strong evidence in point, that usually there are the fewest Owls in the towns most densely populated by the dogs, and conversely. Scarcity of food, of water, or some obscure cause, often makes the dogs emigrate from one locality to another; it is in such "deserted villages" that the Owls are usually seen in the greatest numbers. I have never seen them so numerous as in places where there were plenty of holes, but where scarcely a dog remained.

Courtship.—Mrs. Irene G. Wheelock (1904) says: "While the courtship of these queer birds lacks the grotesqueness of that of the sage grouse, it has some features no less amusing; after watching a pair, you will conclude, as I did, that the sofa-pillow caricatures are not far from the truth. Sitting as close together as possible on top of their chosen burrow, they converse in soft love notes not unlike a far-away 'kow-kow-kow' of a cuckoo; at the same time caressing with head rubbings and billings."

Nesting.—I have never seen any such large colonies of burrowing owls as those referred to above, and doubt if there are many such left. I have seen only scattering, isolated pairs in North Dakota, Saskatchewan, Arizona, and California. The first nest I dug out was in an old badger hole under a road in North Dakota, on June 13, 1901; the nest was in a cavity, 6 inches high by 8 inches wide, about 30 inches underground; the burrow was about 6 feet long; it and the nest were profusely lined with finely chipped, dry horse droppings. This lining, which usually shows at the entrance of the burrow, seems to be characteristic of occupied nests. Dry chips of cow dung are often used for the same purpose. W. Leon Dawson (1923), in three instances, found the tunnels lined copiously with wings of the black tern. He says that, in California, "whenever food is plenty and the ground inviting, Burrowing Owls are likely to form little colonies, ten or a dozen pairs being found in a stretch of two or three acres."

Major Bendire (1892) gives the following comprehensive account of the nesting habits:

> When not disturbed, the same burrow is used from year to year; in such a case it is cleaned out and repaired, if necessary. In different localities their choice in the selection of nesting sites varies somewhat. At Fort Lapwai, Idaho, they generally selected a burrow on a hillside with a southerly exposure, while at Walla Walla their nests were always found in burrows on level ground. At Camp Harney, Oregon, where the Burrowing Owls were not very common, one under a large basaltic bowlder seemed to be a favorite site with them, and here they encroached upon the timber in the foothills of the Blue Mountains. At Fort Custer, Montana, I found them mostly on level ground, generally bottom lands, and always at the outskirts of a prairie dog village. On the Pacific coast the burrows of the ground squirrel are more often used for nesting sites, and occasionally those of badgers, which are quite common in some sections. If one of the former is selected, it has first to be considerably enlarged, and which requires a good deal of patient labor on the part of the Owls to accomplish. While stationed at Fort Lapwai I had an opportunity to see an Owl at work enlarging and cleaning out a burrow. The loosened dirt was thrown out backward with vigorous kicks of the feet, the bird backing gradually toward the entrance and moving the dirt outward in this manner as it advanced. These burrows vary greatly in length and depth, and are rarely less than 5 feet in length and frequently 10 feet and over. If on level ground they usually enter diagonally downward for 2 or 3 feet, sometimes nearly perpendicularly for that distance, when the burrow turns abruptly, the nesting chamber being always placed above the lowest part of the burrow. If in a hillside it will frequently run straight in for a few feet, and then make a sharp turn direct to the nesting chamber. At other times the burrow follows the curves of a horseshoe, and I have more than once found the eggs in such a burrow lying within 2 feet of the entrance and close to the surface of the hill on a trifle higher level; where, had it been known they could have been reached with little trouble. These burrows are generally about 5 inches in diameter, and the nesting chamber is usually from 1 foot to 18 inches wide. After the burrow is suitably enlarged, especially at the end, dry horse and cow dung is brought to the entrance of it, where it is broken up in small pieces, carried in and spread out in the nesting chamber which is usually lined with this material to a thickness of 1 or 2 inches, and I have never found any other material in the nest. In California, however, they are said to line them occasionally with dry grasses, weed stalks, feathers, and similar materials. On one thing most observers agree, namely, that their burrows invariably swarm with fleas.

Dr. A. K. Fisher (1893b) says: "Among the mammals whose deserted burrows are used by this bird may be mentioned prairie dogs, spermophiles, woodchucks, viscachas (South America), wolves, foxes, badgers, skunks, and armadillos. It will be seen from this extensive list that the Owl seldom wants for a home, as one or more of the above species are found in some part of its range. Various authors have stated that the bird sometimes excavates a burrow for itself, but there is no ground for the statement, for in no instance has it been observed in the work of excavation."

In addition to the usual materials mentioned above, these owls sometimes line their burrows with the remains of their food and a variety of other rubbish. Dr. Coues (1874) says, of a nest reported to him by Dr. C. S. Canfield: "In the passage leading to it there were small scraps of dead animals, such as pieces of the skin of the antelope, half dried and half putrified; the skin of the coyote, etc.; and near the nest were the remains of a snake that I had killed two days before, a large *Coluber ?* two feet long. The birds had begun at the snake's head, and had picked off the flesh clean from the vertebræ and ribs for about one-half its length; the other half of the snake was entire. The material on which the young birds rested was at least three inches deep."

Mrs. Florence M. Bailey (1928) writes: "At one nest entrance near Roswell, Mr. Bailey noted a great abundance of dry horse manure, some corn cobs, charcoal, tufts of cow hair, bits of hide, pieces of bone, a child's woolen mitten, a piece of calico, and other rags, shore lark and other bird feathers, and bits of insects. Part of this material was evidently the remains of food. The rest may have been collected on the principle that Rock Wrens apparently mark their nest hole in a cliff full of holes, as a matter of convenience; or, if prairie dogs ever enter each other's burrows, the door plate may be to prevent unpleasant mistakes. The smooth brown ejected pellets are easily picked up around the burrows."

While driving across the prairie in Cochise County, Ariz., on April 26, 1922, we saw a burrowing owl sitting on the mound at the entrance of its burrow, close to the road; on digging it out we found the burrow to be semicircular, measuring 9 feet around the curve but only 5 feet in a straight line from the entrance to the nest cavity, which was only 10 inches below the surface. The female was sitting on nine fresh eggs.

Eggs.—Bendire (1892) says:

> The number of eggs laid by the Burrowing Owl varies from six to eleven. From seven to nine are more often found, while sets of ten and eleven are not especially rare, and Mr. Walter E. Bryant, of Oakland, California, found one of twelve near Carson, Nevada. The eggs are usually found in a single layer and disposed in the form of a horseshoe. On two occasions in extra large sets, I found them placed on top of each other.
>
> It is astonishing how they manage to cover them all, but they do, and it is rare to find an addled egg. * * *
>
> The eggs of the Burrowing Owl, after they are washed, are pure white in color, but as taken from the burrow they are ususally much soiled by the excrement of the numerous fleas inhabiting these domiciles, and bear then no resemblance to white. They are much more glossy than most Owls' eggs and are usually rounded ovate in shape. The shell is close grained and smooth, but in some sets it is strongly granulated.

The measurements of 214 eggs in the United States National Museum average 31 by 25.5 millimeters; the eggs showing the four extremes measure 34 by 27, 31 by 28, 28 by 25, and 32 by 24 millimeters.

Young.—Major Bendire (1892) says that "both parents assist in incubation, which lasts about three weeks, and but a single brood is raised in a season. A second, and somewhat smaller set is frequently laid in the same burrow or in another close by, if the first eggs are taken."

Grinnell, Dixon, and Linsdale (1930) observed an interesting habit of young burrowing owls, of which they say:

> When the burrow had been dug out two-thirds of the way to the end, a buzzing screech was heard that seemed so nearly like a muffled rattle of a rattlesnake that it was hard to feel sure that there was no snake in the burrow. As the digging proceeded this noise was heard more and more clearly. Finally the terminal cavity was opened up, disclosing only the six young owls. Their main defense was the utterance of the rasping, penetrating, rattling hiss, nearly like the angry buzz of a rattlesnake when disturbed on a warm day. The bill clicks which were produced less frequently than the rattling notes were reather weak. The latter utterance was deterrent in our case; might it not be so as regards carnivores that dig out or enter burrows such as the burrowing owls inhabit? Badgers, coyotes, weasels, and possibly such rodents as marmots and ground squirrels might thus be deterred from molesting the owls.

John McB. Robertson (1929) gives the following account of the methods employed in feeding the young, after they were large enough to come out of the nest:

> The young owls were usually in a compact group on the highest part of the mound, while the adult, only one adult being observed, had several lookout stations, the nearest one being the top of a pile of baling wire and other junk on the alkali flat, and the others were fence posts at various distances from the burrow.
>
> The usual program was as follows: The adult, frequently looking skyward, sighted some flying insect passing over, launched out in pursuit, climbing rather laboriously upward at a sharp angle and sometimes spirally, often to a height of 150 feet or more, and on overtaking the flying prey seized it with one foot. Then came a pause during which the prey was transferred to the beak, then a long glide, on set wings, directly to the nest. The young, on seeing the adult coming with food, rushed down the slope toward it, and then turned and rushed back as the adult passed over their heads to alight on the highest point of the mound. Then came a scuffle that would have done credit to a football game. However, actual possession of the coveted morsel seemed to be respected, and the lucky youngster was allowed to devour it at leisure. After a brief pause the adult returned to a vantage point to watch for more game. * * *
>
> As the young grew older and learned to fly they sometimes flew toward and intercepted the adult before the burrow was reached; this was successful only in cases where the adult flew close to the ground after making a low, or a ground, capture. The adults sometimes ate the prey themselves, and in this case it was sometimes held up to the beak with one foot while the bird stood on its perch.
>
> On one occasion a weasel appeared, crossing the pasture, and was immediately assaulted by the owls. The young were flying quite well at this time and they joined in the attack, hovering over the scurrying weasel and swooping at it from behind with extended claws. The weasel paused and faced them at times and then hurried on; I could not be sure that they actually struck him, but they came close enough to do so. Birds from other families joined the fun, and at one time there were ten owls in the air together. The weasel was escorted about one hundred yards before the chase was abandoned.

Plumages.—The newly hatched young burrowing owl is but scantily covered, on the feather tracts only, with grayish-white down, basally dusky; bare skin shows between the feather tracts, even after the juvenal plumage has begun to grow. This first plumage seems to appear almost simultaneously on all the feather tracts and on the wings and tail. By the time the young bird is half grown it is competely covered with the distinctive juvenal plumage. In this plumage, the crown, hind neck, and back are plain, dull, grayish brown to buffy brown, most grayish on the head; the wing coverts are mostly light buff, but the rest of the wings and the tail are like those of the adult; the under parts and upper tail coverts are pale buff and unspotted, with a suffusion of "wood brown" across the upper chest. This plumage is worn until July or August, when a complete molt of the contour plumage begins on the sides of the breast, the scapulars, and wing coverts; this molt is completed in September, when the first winter, or practically adult, plumage is acquired.

Adults have a complete annual molt in August and September. Many birds show so much fresh plumage in spring that I suspect they may have a partial prenuptial molt of the body plumage, though I have not been able to detect it. The wear and tear on the plumage, owing to subterranean life, might well make such a change desirable.

Food.—The burrowing owl is unquestionably one of our most beneficial birds of prey, for it destroys very few small birds, mainly to feed its young, and it subsists almost entirely on insects and injurious rodents, which it destroys in enormous numbers. Fortunately most ranchmen and farmers appreciate this fact and do not persecute it.

Its insect food includes grasshoppers, locusts, beetles, Jerusalem crickets, mole crickets, black crickets, caterpillars, dragonflies, and various other insects, many of which it catches on the wing. Major Bendire (1892) says:

> They hunt their prey mostly in the early evening and throughout the night, more rarely during the daytime. As soon as the sun goes down they become exceedingly active, and especially so during the breeding season. At such times they are always busy hunting food, and go and come constantly, and they may often be seen hovering suspended in the air like the Sparrow Hawk, locating their prey or darting down noiselessly and swiftly, and grasping it with their talons without arresting their flight an instant. The actual amount of food a pair of these birds require to bring up their numerous family, generally averaging eight or nine, is something enormous. Each Owl will eat fully its own weight in twenty-four hours, if it can get it.

Dr. Fisher (1893b) says that "of 32 stomachs examined, 3 contained small mammals; 3, lizards; 3, scorpions; 1, a centipede; 30, insects; and 1 was empty." In his table of stomach contents, he records seven stomachs that contained between 40 and 60 locusts and other insects each, and he says that "this little Owl will chase and devour grasshoppers until its stomach is distended to the utmost."

Next in importance come the mammals, including mice, rats, and ground squirrels of various species, young prairie dogs, young cottontails, pocket gophers, chipmunks, shrews, and even bats. To test the ability of these owls to kill ground squirrels, Major Bendire (1892) experimented with a pair he had in captivity; he writes:

> I fed a pair of these Owls four live full-grown Townsend's ground squirrels in one day, besides the carcasses of five small birds that I had skinned, and was astonished at the ease and celerity with which these rodents were killed and the small amount of resistance they made. I watched the proceedings through a small hole in the door. As soon as a squirrel was turned loose in the room with the Owls, one of them would pounce on it, and, fastening its sharp talons firmly in the back of the squirrel, spread its wings somewhat, and with a few vigorous and well-directed blows of its beak break the vertebræ of the neck, and before it was fairly dead it commenced eating the head. This was always eaten first and is the favorite part. Next morning there was but little left of squirrels or birds, and the two Owls had certainly eaten considerably more than their own weight in the twenty-four hours.

C. E. McBee (1927) reports large numbers of mice found in burrows of these owls near Kiona, Wash.; one burrow contained 25 mice and 3 sage rats, another 15 mice and 2 sage rats, and others lesser numbers; in examining a number of their nests, he found only one bird, a young dusky horned lark. Among the birds taken, horned larks seem to be oftener reported than any other species. F. A. Patton (1926), writing from South Dakota, says: "In examining these burrows I found about the entrance, and down in the burrows, quantities of feathers of the Desert Horned Lark, mostly wing and tail feathers. Digging into the burrows I would find from four to six partly eaten larks, mostly young birds just flying; also usually a less amount of partly eaten field mice. Not a burrow did I find but showed evidence that more than fifty per cent of the food of these owls were larks, which were being killed by the thousands."

Feathers, or other remains, of least sandpiper, black-headed grosbeak, western meadowlark, Bell's vireo, and various sparrows, or other small birds, have been found in or about the burrows, but most observers agree that they form only a small part of the total food. Bendire never found any bird remains in any of the many burrows that he examined.

Various miscellaneous items enter into the food of the burrowing owl, such as lizards, snakes, frogs, toads, salamanders, fishes, scorpions, centipedes, and myriapods. Paul Thompson writes to me that he has found the remains of a cecropia moth, two forewings and head, at the entrance of a burrow, and that the remains about burrows near ponds and creeks consist largely of crayfishes. In one case he found a wing and a leg of a burrowing owl at the entrance of a burrow; this owl may have been killed on a nearby road and brought to the burrow to be eaten.

A comprehensive study of the food habits of burrowing owls in northwestern Iowa has recently been published by Errington and Bennett (1935).

Behavior.—As an exception to the rule, stated in my opening paragraph on this species, it is interesting to note that Clinton G. Abbott (1930), when he came to San Diego in 1921, found burrowing owls living—

> in well-settled parts of the city. A certain individual roosted daily in a pepper tree in front of the Central Y. M. C. A., almost in the heart of the business district. On El Cajon Boulevard, which was a well-traveled thoroughfare even in those days, Burrowing Owls could often be seen perched on the side-walk curb. They lived in the culvert drains under the intersecting streets.
>
> The paving of this boulevard has driven these birds away, and the Y. M. C. A. "Billy" has gone, yet in spite of San Diego's present 150,000 population Burrowing Owls still subsist wherever there is any extent of vacant land. In quiet streets they can sometimes be seen hawking about the arc-lights at night and settling on the pavement below—probably in pursuit of moths. On Reynard Way, which is a short-cut between down town and the Mission Hills residential district, these Owls are common, because many of the sloping lots on each side have not yet been built upon. Even in broad daylight a "Ground Owl" may often be seen standing upon some advertising sign, apparently unconcerned at the passing stream of automobiles.

Dr. Coues (1874) has given a far better word picture of this curious owl than I can write, as follows:

> As commonly observed, perched on one of the innumerable little eminences that mark a dog-town, amid their curious surroundings, they present a spectacle not easily forgotten. Their figure is peculiar, with their long legs and short tail; the element of the grotesque is never wanting; it is hard to say whether they look most ludicrous as they stand stiffly erect and motionless, or when they suddenly turn tail to duck into the hole, or when engaged in their various antics. Bolt upright, on what may be imagined their rostrum, they gaze about with a bland and self-satisfied, but earnest air, as if about to address an audience upon a subject of great pith and moment. They suddenly bow low, with profound gravity, and rising as abruptly, they begin to twitch their face and roll their eyes about in the most mysterious manner, gesticulating wildly, every now and then bending forward till the breast almost touches the ground, to propound the argument with more telling effect. Then they face about to address the rear, that all may alike feel the force of their logic; they draw themselves up to their fullest height, outwardly calm and self-contained, pausing in the discourse to note its effect upon the audience, and collect their wits for the next rhetorical flourish. And no distant likeness between these frothy orators and others is found in the celerity with which they subside and seek their holes on the slightest intimation of danger.

Dr. Fisher (1893b) says: "The flight is rather laborious, irregular, and somewhat jerky, and is seldom of long duration. The bird rarely rises high in the air, but passes noiselessly along the ground, and when alighting drops very much after the manner of the woodcock." I should hardly call the flight laborious or jerky; it seemed to me quite strong and easy, and I was always impressed with the large expanse of wing on such a small body. About its breeding grounds it makes only short flights at low elevations from one perch to another, keeping hardly more than a short gunshot range from the intruder. The fact that it nests on several islands off the Pacific coast, and that it has alighted on ships at sea, shows that it is capable of prolonged flights. It is usually seen perched on the level ground, or on the little eminences at the entrances of burrows, more from necessity than choice; but I believe that it prefers to perch on fence posts, wire fences, low bushes, or even trees where these are available, selecting the best lookout points it can find. Some observers have reported it as shy, especially on bright, sunny days, but I have generally found it rather easy to approach; once on a dull, cloudy day I was able to crawl up to within a few feet of one and photograph it at short range.

Burrowing owls seem to have a curious habit of following a moving animal, perhaps to secure whatever small game may be stirred up by it. Aldo Leopold (1923) mentions one that "made a daily practice of 'pursuing' a bird dog when the dog was turned loose for exercise near the golf links of the Albuquerque Country Club. * * * When the dog first appeared on the owl's range, he would chase the owl for a short distance. When this was over, the owl would chase him for distances up to 150 yards, flying about five feet behind and above him as the dog hunted." E. S. Cameron (1907) says that "in summer these owls have a habit of making short flights along the wire fences in front of horses, perching on the wires until approached quite close."

Voice.—The vocal performances of the burrowing owl are not very elaborate and consist mainly of two very different notes, the cackling alarm note, *cack-cack-cack-cack*, given as it darts into its hole or flies away, and the so-called love song, a rapidly uttered, cooing note, given in the spring on its nesting grounds. Claude T. Barnes says in his notes: "As I approached, the languid owl flew to a nearby post uttering occasionally a raucous *twit*, or *twut*, *twut*, *twut*." Bendire (1892) writes:

> They appear to be mated when they make their first appearance in the early spring, and I believe remain paired through life. At this season, where they are abundant, and they are generally found in little colonies of several pairs at least, their peculiar love note can be heard on all sides about sundown; it reminds me more of the call of the European Cuckoo (*Cuculus canorus*) than anything else, a mellow sonorous and far-reaching 'coo-c-o-o', the last syllables somewhat drawn out, and this concert is kept up for an hour or more. These notes are only uttered when the bird is at rest, sitting on the little hillock surrounding its burrow. While flying about, a chattering sort of note is used, and when alarmed a short shrill 'tzip-tzip.' When wounded and enraged it utters a shrill scream and snaps its mandibles rapidly together, making a sort of rattling noise, throws itself on its back. ruffles its feathers, and strikes out vigorously with its talons, and with which it can inflict quite a severe wound.

Field marks.—The burrowing owl could hardly be mistaken for anything else. It is the only small owl that habitually lives on the ground in open places; the short-eared owl is much larger and frequents grassier places. A small owl, with very long legs, a very short tail, a compact, rounded head and yellow eyes, is sure to be a burrowing owl. Its curious bobbing habit also is distinctive.

Enemies.—Burrowing owls have few natural enemies, though rattlesnakes doubtless destroy some eggs and young. Dr. J. F. Brenckle suggests in his notes that the nests may sometimes be invaded by cats and says that "the highway seems a favorite feeding ground, and, with the bright lights and speed of cars, many are killed or wounded." Undoubtedly many are killed by the indiscriminate use of carbon disulphide in campaigns against ground squirrels; no distinction is made between the holes occupied by squirrels and those in which the owls are nesting; all the holes are poisoned and sealed, thus killing many a family of owls, the farmer's best friends.

Migration.—Throughout the more northern portions of their range burrowing owls are more or less migratory. Bendire (1892) says: "In Washington, Idaho, and Oregon, they appear to migrate about the beginning of November and sometimes earlier, returning to their summer homes in the early part of March. At any rate, without actually examining any of their burrows during the winter months, to ascertain their presence, I never saw one of these birds, as far as I can remember, sitting in front of these at such times, and I have lived where they were very common and certainly would have noticed one occasionally if actually about."

Dr. J. F. Brenckle, who has banded some 300 burrowing owls near his home in Northville, S. Dak., has sent me some interesting notes on his returns. Many of the returns were of birds killed on highways at nearby points, and one was killed on a railroad track. Of the more distant returns, one was found wounded on a highway near Royal, Nebr., on October 1, 1931; one was captured at Gunter, Tex., on January 7, 1932; one was taken at Edmond, Okla., on December 12, 1932; and one was captured at Willow, Okla., on April 4, 1933. Evidently some of these owls indulge in extensive migratory movements.

Winter.—Apparently some of these little owls remain on their northern breeding grounds all winter, for Dr. G. S. Agersborg (1885), referring to "southeastern Dakota", says: "In the winter as many as twenty of these birds may be found nestling together in one hole. They are always at such times abundantly supplied with food. I have found at one time forty-three mice and several Shore Larks scattered along the run to their common apartment. They forage in fine weather and retreat to their dirty adobes when cold weather threatens."

Dr. Coues (1874) quotes Townsend as saying: "I found both the prairie-dogs and the Burrowing Owls abroad and very active on pleasant days in December and January, on the plains of Western Kansas, although the temperature often fell nearly to zero (Fahrenheit) during the nights following. I was also assured by old residents of the plains that both these animals are frequently seen abroad during pleasant weather throughout the winter."

DISTRIBUTION

Range.—North America to southern Canada, parts of the West Indies, Central and South America.

Breeding range.—The burrowing owl breeds **north** to southern British Columbia (Okanagan); southern Saskatchewan (Many Island Lake, Crane Lake, Rush Lake, Moosejaw, and Indian Head); and southern Manitoba (Oak Lake, Riding Mountain, Portage la Prairie, and Kildonan). **East** to Manitoba (Kildonan); Minnesota (Swift County, Montevideo, and Sherburn); Iowa (Granville, Paton, Ashton, and Wall Lake); eastern Nebraska (Neligh, Horth Loup, and Wilber); Kansas (Portis, Garden Plain, Harber, and Medicine Lodge); Oklahoma (Fort Reno, Norman, and Mount Scott); western Texas (Bonham and Austin); southeastern Florida (Fort Drum, Fort Thompson, Hialeah, and Miami); Bahama Islands (Eleuthera, Cat Island, and Great Inagua); Dominican Republic (Monte Cristi, Sosua, Santiago, Tubanos, Bani, and Beata Island); Lesser Antilles (Nevis, Antigua, and Guadeloupe); probably British Guiana; Brazil (Para, Bahia, Campos, and Itapetinanga); Uruguay (Cerro Largo, Rocha, and Maldonado); and Argentina (La Plata, Dolores, Cape San Antonio, Bahia Blanca, Rio Negro, and Cape Espiritu Santo). **South** to southern Argentina (Cape Espiritu Santo); and Chile (Rio Imperial). **West** to Chile (Rio Imperial, Molina, Coquimbo, and La Serena); Ecuador (Puna Island, Santa Elena, and Concepcion); Panama (Chiriqui); Guatemala (San Jose, Duenas, and San Geronimo); Oaxaca (Tehuantepec); the "plains of Colima"; Revillagigedo Islands; Baja California (San Jose del Cabo, Mira Flores, Todos Santos, El Rosario, Cedros Island, and Calexico); California (San Clemente Island, San Nicolas Island, Santa Rosa Island, Alcalde, Paraiso Springs, Alameda, Oakland, East Park, Alton, and Tule Lake); Oregon (Mud Creek, Silver Lake, Corvallis, Scio, and The Dalles); Washington (Yakima Valley, Cheney, and Riverside); and British Columbia (Osoyoos Lake and Okanagan).

The range as above outlined is for the entire species, which has, however, been separated into several geographic races and is, moreover, discontinuous. For example, in the Eastern United States the only region where the species is found regularly is in southern Florida, which is occupied by the Florida burrowing owl (*Speotyto c. floridana*). This form also is found on the Bahama Islands. The Hispaniolan burrowing owl (*S. c. troglodytes*) occurs chiefly in Haiti and the Dominican Republic; the Guadeloupe burrowing owl (*S. c. guadeloupensis*) and the Antigua burrowing owl (*S. c. amaura*), both of which are probably now extinct, are confined to a few islands of the

Lesser Antilles; and the birds of the Revillagigedo Island group, off the west coast of Mexico, has been named *S. c. rostrata.* The typical form *S. c. cunicularia* is South American.

The western burrowing owl (*S. c. hypugaea*) occupies the North American portion of the ranges, except for Florida. It is migratory in the northern areas, and in some parts of Central America it apparently occurs only as a winter resident.

Winter range.—As stated above, this species is migratory only in the northern parts of its range. It will occasionally remain throughout the winter almost to the limits of the breeding range but ordinarily at this season it is found north to California (East Park, St. John, and Chico); southern Arizona (Parker and Tucson); southern New Mexico (Mesilla Park, Tularosa, and Carlsbad); Texas (Lipscomb, Decatur, and Corsicana); and southern Florida (Miakka Lake, Istokpoga, and Fort Drum).

Spring migration.—Early dates of spring arrival are: Kansas (may winter rarely in southern part)—Wellington, March 22; Wichita, April 7; Ellis, April 8. Nebraska (winters rarely)—Beatrice, March 24; Valentine, April 6; Antioch, April 8. Iowa—Sioux City, March 20; Ashton, April 22. South Dakota—Fort Pierre, April 5; Forestburg, April 6; White River, April 15. North Dakota—Marstonmoor, April 7; Jamestown, April 10; Argusville, April 20. Minnesota—Sherburn, April 18. Manitoba—Margaret, April 14; Aweme, April 24. Saskatchewan—Indian Head, April 24. Colorado (winters rarely)—Grand Junction, March 23; Loveland, March 28; Denver, April 14. Utah—Salt Lake County, April 17. Wyoming—Wheatland, March 12; Laramie, April 15. Idaho—Meridian, March 5; Deer Flat Refuge, March 18. Montana—Corvallis, April 15; Billings, April 21; Fort Custer, April 25. Nevada (may winter rarely)—Carson City, April 26. Oregon (winters rarely)—Camp Harney, March 13; Klamath Lake, March 31. Washington (may winter rarely)—Walla Walla, March 1; North Yakima, March 7; Prescott, March 19. British Columbia (winters rarely in extreme southern part)—Okanagan, April 2; Osoyoos Lake, April 6; Penticton, April 15.

Fall migration.—Late dates of fall departure are: Washington (may winter rarely)—North Yakima, October 1; Grays Harbor, October 19. Oregon (winters rarely)—Cold Springs, October 14. Nevada (may winter rarely)—Overton, November 22. Montana—Big Sandy, September 14; Fort Benton, September 20. Idaho, Deer Flat Refuge, November 1; Meridian, December 14. Wyoming—Hutton Lake, October 5; Midwest, October 7; Wheatland, November 2. Colorado (winters rarely)—Boulder County, October 13; Jackson County, October 26; El Paso County, November 2. Manitoba—Treesbank, September 25; Oak Lake, October 4. North Dakota—Stump Lake, September 29; Jamestown, October 1. South Dakota—

Forestburg, October 1; Harrison, October 18. Iowa—Woodbury County, October 5. Nebraska (winters rarely)—Gresham, September 15; Spalding, September 24; Chadron, October 1. Kansas (may winter rarely in southern part)—Wichita, October 24; Cimarron, November 30. Oklahoma (may winter rarely)—Arnett, October 7; Fort Sill, October 10.

The migration of these owls is perhaps more graphically portrayed by three cases of individuals marked with numbered bands. One was banded at Northville, S. Dak., on July 1, 1931, and recaptured at Royal, Nebr., about October 1, 1931; the second, banded at West Kildonan, Manitoba, on July 31, 1926, was shot at Spalding, Nebr., on September 24, 1927; the third, also banded at Northville, S. Dak., on June 27, 1931, was retaken near Gunter, Tex., on January 7, 1932.

Casual records.—On several occasions the burrowing owl has been taken outside of its normal range. Among these are the following: About half a dozen specimens have been taken in Louisiana (Chenier Tigre, March 6, 1918, and December 10, 1925; Grand Isle, one on April 22 and two on April 27; Baton Rouge, March 11, 1933). Apparently all these belonged to the western subspecies. A specimen collected on Blakely Island, opposite Mobile, Ala., on February 3, 1912, is the Florida race. A specimen was taken in Porter County, Ind., on April 16, 1924; one was captured alive on Wolfe Island, Ontario, in the fall of 1894; on October 22, 1918, one came on board a naval vessel off Hampton Roads, Va.; one was reported from New York City in August 1875; one was collected at Newburyport, Mass., on May 15, 1875; and a specimen was found dead at Dover, N. H., about February 20, 1922.

Probably the most northern occurrence is a nonbreeding male collected on July 8, 1921, ten miles north of Poplar Point, Manitoba.

Egg dates.—Florida: 52 records, March 22 to May 21; 26 records, April 4 to 23, indicating the height of the season.

California: 41 records, April 1 to June 17; 21 records, April 14 to May 2.

Colorado and Kansas: 11 records, March 29 to July 1; 6 records, May 14 to June 2.

Dakotas: 7 records, May 1 to June 13.

SPEOTYTO CUNICULARIA FLORIDANA Ridgway

FLORIDA BURROWING OWL

PLATES 87–89

HABITS

Ridgway (1914), although he originally described this owl under the above name, treats it in his latest work as specifically distinct from the western bird, and applies the name *Speotyto floridana floridana* to the birds of Florida and the Bahamas. He describes it as "above darker and much less buffy brown than in any of the forms of *S. cunicularia*, with the spotting dull white instead of more or less buffy; ground color of under parts much less buffy (dull white, buffy only on thighs and under wing-coverts); under wing-coverts spotted with brown, at least toward edge of wing; tarsus less extensively feathered, the feathering shorter; wing and tail averaging much shorter than in *S. cunicularia hypogaea* and bill larger."

The home of this owl is on the prairies of central and southern Florida. One naturally associates burrowing owls with the western prairies and open plains, and so it is not surprising that these birds are to be found on the wide, open spaces in the flatter portions of Florida. On my first visit to Florida I drove for many miles over the extensive prairies that lie between the marshes of the upper St. Johns River and the east coast and was greatly impressed with their many reminders of the western plains; there was the broad expanse of flat grassland, stretching away nearly to the horizon, where distant clumps of trees suggested the tree-claims or the timber belts along the western streams; only the scattered palmetto hammocks broke the illusion; roving bands of wild cattle, with an occasional picturesque cowboy rounding them up, a stray upland plover, then on its way north, the numerous sloughs and ponds, and frequent glimpses of sandhill cranes, all added to the picture. The great Kissimmee Prairie, which I visited later, furnishes even more congenial homes for burrowing owls and cranes in its vast expanse of flat grassy plains.

Charles J. Pennock, who has had considerable field experience with these owls, has sent me some very elaborate notes on them; as to their haunts, he says: "These almost treeless tracts may vary in size from a few acres to several square miles, may be a disconnected series of open moors or fieldlike tracts, or they may be a chain of larger or smaller prairies, with sloughs, hammocks, or ponds intervening. Wherever found nesting, they are quite sure to be on the higher, drier, opener, and least fertile places. So little above the underground water table is much of the country that these birds frequent that a very short distance, even a few rods, may determine the presence or absence of *Speotyto*, for, where the ground drops to a depression, a pond may be formed, or, failing that, scrub palmettos or other coarse plants may grow, among which the owls do not find congenial abiding places. Even the presence of an occasionally used roadway across a prairie may make the difference to these birds, and it is quite usual to find them located on the borders of such paths or, as I have seen more than once, their domiciles on the very shoulder of the road, between the side ditch and the wheel track. No doubt such sites mean a drier nursery, for they are not infrequently delayed in their home building by rains in March."

This would seem to indicate that these owls always select high, dry ground for their nesting sites; but Samuel N. Rhoads (1892) found a large colony in soil that had previously been very wet, "a continuous colony, three miles long, of breeding Owls. The retreating waters of the adjoining slough had left a margin of flat, grass-grown sand, of varying width, between the swamp and the saw palmettoes, and extending indefinitely in the direction of the stream. This formed the breeding ground of several hundred pairs of Owls."

W. P. Owen writes to me that he and H. H. Bailey have noticed "the moving of the burrowing owl from its accustomed habitat, the golf courses, to the dairy pastures", in Dade County.

Nesting.—Probably no such large colonies as that referred to above exist today. W. J. Hoxie wrote to me of visiting a large deserted colony on the St. Johns Prairie in 1893, where the remains of the old towns were strikingly apparent for miles in groups of from six to twenty on all sides; "the mounds, being constructed of the deeper subsoil, long resisted the encroachment of the vegetation and stood bare and sunscorched." Mr. Pennock says: "On but one occasion did I find a close community; then there were six or eight pairs nesting on a restricted tract of not exceeding four or five acres. * * * On only a single occasion, did I find these birds occupying a burrow, other than of their own excavation. This burrow, from its location, size, and form, was unquestionably the work, originally, of the highland tortoise or 'gopher', so called by the residents."

Other observers all agree that these owls excavate their own burrows, mainly because the "gophers" are seldom found on the prairies frequented by the owls, and because there are very few burrowing mammals to be found in the same region. Occasionally, a deserted burrow of a fox or a skunk may be occupied, but these are generally in thick cover, which the owls do not like.

Most of the burrows that I have seen have been widely separated, single nests; but once, while hunting with Mr. Pennock in Charlotte County, we found five pairs of owls nesting within the space of a few acres. This was on March 5, 1925, and the owls had not laid in the only burrow we dug out, though the burrow and nesting chamber were apparently finished; the hole ran downward at a sharp angle for 15 or 20 inches, and along at that depth, with one slight turn in it, for about 6 feet. Mr. Pennock says that the burrows vary in length from 5 to 9 feet, and are usually shallower than those of the western burrowing owl, from 14 to 20 inches below the surface of the ground. Sometimes they are quite straight, but often they make one, or rarely two, abrupt turns. He says that sometimes the eggs are placed directly on the bare earth, but usually some material is used as bedding, grass cut to short lengths, rarely some hair or feathers, and once a lot of shredded newspaper; more frequently small pieces of dry horse or cow manure are used, sometimes in considerable quantities; once more than half a peck of finely broken cow manure was taken from one cavity.

Referring to the colony described above, Mr. Rhoads (1892) says:

> With three exceptions all of the twenty burrows I explored were dug in the moist, sandy margin of the slough, from twenty to one hundred feet down the gentle, grassy slope between the thickly fringed palmetto bank and the water's edge. The more recently constructed burrows were invariably nearer the water, owing to the greater ease of digging in the wet sand. In these cases the burrow throughout its entire length would just graze the lower surface of the thin sod, occasionally even penetrating it, causing, in such an event, its abandonment. If not abandoned, one of the myriad roving cattle would be likely soon to set foot on it and break through, or a sudden shower might fill it with water.

Eggs.—The Florida burrowing owl lays four to eight eggs, usually five or six. The eggs are indistinguishable from those of the western bird. The measurements of 50 eggs in the United States National Museum average 32.4 by 26.9 millimeters; the eggs showing the four extremes measure **34.3** by 28, 33 by **29**, **28.6** by 25.4, and 30.8 by **25** millimeters.

Young.—Incubation is shared by both sexes, and probably lasts about three weeks. Mr. Rhoads (1892) says: "The voracity of the young is phenomenal. I kept seven, of different ages, in a tin box for several days. Beside eating everything, fresh or putrid, that was offered, they attacked and devoured each other. I was forced to kill the three remaining cannibals to preserve them."

Plumages.—The plumage changes of the Florida burrowing owl are apparently similar to those of the western bird. Mr. Pennock says, in his notes: "In coloring the adult female is decidedly more rufous on the back than is the male, and the spots on the breast and belly of the male are more sharply defined, rather darker with more distinct margins. This is not often sufficiently pronounced to be apparent in the single bird at rest. In flight, the deeper, brownish tinge on the back of the female will at times, in certain lights, become evident. In a series of birds, with males and females separated, the difference becomes clearly marked."

Food.—According to Mr. Pennock, the food of these owls consists largely of night-flying beetles; "when shot early in the morning, their stomachs are usually well filled with such food. Other food noted was remnants of a crab, a small decapitated snake, and parts of a frog", found about the entrances to burrows.

Mr. Rhoads (1892) writes:

> When the nest contained young, the mound and burrow were strewn with the rejected remains of their food, but, strange to say, there was no evidence that the young or old ejected the pellets so peculiar to rapacious birds. If they had done so we certainly should have found them. Among these remains were detected the legs and elytra of various grasshoppers and coleoptera, skulls of a

very small rodent, skulls and backbones of fish, one of which was six inches long, the skins of snakes, the dried body of a lizard, frogs and crayfish, and feathers of four or five species of birds, noticeable among which were those of the Cuban Nighthawk, Bobolink and Savanna Sparrow.

Behavior.—Mr. Pennock says: "The flight is more undulating than that of any other bird I know, a series of abrupt, sweeping rises and swinging drops, rarely making a flight of more than 40 or 50 yards, often swinging back to, or near, their home-site, or more frequently dropping down to another burrow entrance, perhaps not over 20 or 30 yards distant." He thinks that this second burrow may be a haven of refuge in time of trouble, as the owls often have two burrows in use, one for nesting and one for a resting place.

I have always found the Florida burrowing owl rather tame and easily approached; others have had the same experience with it. Once I lay for half an hour within 8 feet of one, as it stood on its mound, preening and oiling its plumage, as a shower was threatening; I even saw it pinch its oil gland; its small bill seemed rather awkward for preening. Although it seemed to be very alert, it paid little attention to me, but kept turning its head quickly in all four directions, looking for prey; two or three times it darted off and caught some insect, either on the ground or in the air, giving a little cry as it started; on returning, it spread its feet widely apart and landed on its mound with a little slide. Once it gaped, half closed its eyes, and dozed for a few moments.

As a rule these owls are very gentle, though they will put up quite a fight when handled; but Mr. Rhoads (1892) says: "The anxiety of the old males whose young are being threatened is so great that I have had them strike my cap awry while digging, and in general the conduct of the females in comparison is shameful. * * * Where four or five pairs were living close together the males would combine their attacks upon me and the females would retire together to some secluded spot and have a talk."

Frederic H. Kennard (1915) writes:

> On approaching an inhabited burrow, if one or both of the owners were not already in sight, they very quickly appeared; and standing bolt upright on their little mound of sand at the mouth of the burrow, would courtesy gravely to me, until on my nearer approach, they would fly off onto the prairie, perhaps fifty or a hundred feet, where they would continue their courtesies, uttering at the same time their calls, *Whit, whit-whit,* a long and two short notes: or *Whit-whit, who-who-who-who-whit,* two short notes followed by a stutter, a little lower in tone but ending with a short sharp *whit* at the end; or *Whit-whit, who-who-who-who-who,* two short *whits,* followed by the stutter. Often instead of flying they would run over the prairie, reminding me of the Robins one sees on the lawn, which after standing upright and still, suddenly bend forward and run.

Bendire (1892) says that "after the breeding season is over, the Florida Burrowing Owl is said to disappear for a time from its usual haunts, but where it goes is not positively known."

Enemies.—Bendire quotes J. F. Menge as saying that "many of their nests are yearly destroyed by skunks and opossums, who seem to be very fond of the eggs." Mr. Hoxie tells me that it has been quite a common practice for the cowboys to shoot these owls, as being detrimental to the cattle business; the only reason for this is that a horse or a cow may occasionally break a leg by stepping into a burrow while running. It would hardly seem that there are enough of the holes to cause much damage in this way, but, sad to relate, any wild creature that interferes in the slightest degree with man's interests has to be sacrificed.

GLAUCIDIUM GNOMA PINICOLA

ROCKY MOUNTAIN PYGMY OWL

HABITS

Contributed by Milton Philo Skinner

The pygmy owl well deserves its name, for it is scarcely as big as a bluebird, and not nearly so large as a robin. It is a hardy, dark grayish-brown, little fellow, and it lives at all seasons of the year upon its favorite mountain ranges in the Western United States and Canada. Still, severe winter storms *may* cause it to seek lower altitudes, temporarily. Although it is seldom found far from trees, it sometimes perches on trees or bushes isolated from the rest of the forest. This is the most eastern of the several subspecies of the pygmy owl. It has not often been reported; yet it seems to be quite abundant. Its small size, its ability to hide in the forest, its many ways and habits so unlike other owls, and its general resemblance to other, commoner, birds tend to confuse the observer even when the pygmy owl is seen. Most curious in an owl is its habit of carrying its tail sticking out at a perky angle (Winson, 1926a).

Nesting.—Nothing is known of the courtship activities preceding the nesting of this subspecies, and not much of the actual nesting itself. As a rule the nest is in the abandoned hole of woodpeckers ranging in size from the hairy woodpecker up to, and including, the flicker. Apparently the Rocky Mountain pygmy prefers a site 8 to 20 feet above ground. The eggs are laid upon the bare wooden bottom of the nest hole, although at times there are feathers and pine needles present. I do not know whether this scanty material is intentionally placed in position, or just accidentally falls there. On the other hand, Major Bendire (1892) found a nest at Fort Klamath where "the cavity was well filled with feathers of various kinds", indicating that here was an attempt at actual nest building. Dates of fresh eggs range from May 10 to the end of June; and, judged from these, only one brood a year is raised. Incubation appears to start as soon as one egg has been laid. Apparently nesting localities may be anywhere within tree limits, from 5,000 feet to 10,000 feet above sea level.

Aretas A. Saunders (1921), speaking of Montana, says: "The only definite knowledge of the nesting of this species in the state is the record of a nest and newly hatched young found on Bridger Creek, Gallatin County, by Mr. Thomas in June, 1909."

In Colorado these nests have been recorded by W. G. Smith, W. H. Bergtold, and Charles F. Morrison. In this State at least, nesting trees have been at comparatively high altitudes above sea level. Mrs. Bailey (1928) records nesting in New Mexico in old woodpecker holes in trees and stumps.

Although the locality is at the extreme western limit of the range of this subspecies, Major Bendire (1892) has given us a fine series of notes from Fort Klamath, Oreg.

> During an absence once from Fort Klamath on official matters, one of my men found on June 10, 1883, a burrow occupied as a nest by the true *Glaucidium gnoma*, which at the time it was first discovered must have contained eggs. * * * The nesting site used was a deserted Woodpecker's excavation, in a badly decayed but still living aspen tree and was about 20 feet from the ground; the cavity was about 8 inches deep and 3½ wide at the bottom. * * * When the nest was shown me [June 25] I had it examined, and, much to my disgust, found it to contain four young birds about a week or ten days old. * * * The cavity was well filled with feathers of various kinds, and contained besides the young, the female parent and a full grown Say's chipmunk (*Tamias lateralis*), that evidently had just been carried in, as it had not been touched. The cavity was almost entirely filled up by the contents mentioned.

Perhaps, when further observations have been made, nesting will be found to be even more like *californicum* than now seems to be the case.

Eggs.—Major Bendire (1892) has recorded that four is the usual number of eggs to a set. Mrs. Bailey (1928) says "three or four, white or whitish" eggs, in New Mexico. Edward A. Preble (1930) adds that there are usually "three or four white eggs, a little over an inch in length, and about the size of robins' eggs." As to shape, pygmy eggs are much more nearly round than most other eggs.

[AUTHOR'S NOTE: The measurements of 21 eggs average 26.6 by 23.2 millimeters; the eggs showing the four extremes measure **29** by **24** and **25.4** by **22.3** millimeters.]

Young.—The young owlets hatch out, as a rule, in June or early in July. They then remain in the nest about four weeks longer, during which time they are carefully looked after by the mother, although the father may bring food to his family at times. Sometimes quite large prey, considering the size of the owls, is brought to the nest.

Plumages.—So far as known, the first plumage is much like the adult plumage, except that it is grayer and not spotted. When the young leave the nest the head is gray and contrasts with the browner color of the back. There are a few faint spots on the forehead but none on the rest of the head; no spots on the other upper parts, or on the brown of the sides of the breast. Later, spots gradually appear in all these places as the bird grows older.

This owl is known to molt late in August or early in September. Mrs. Bailey (1928) says: "It was in the midst of its molt at the time—September 3—its head, body, and yellow feet being pin-feathery, its wing quills only partly new. It was an immature female."

Food.—Probably the Rocky Mountain pygmy owl feeds on all the smaller mammals, birds, reptiles, amphibians, and larger insects living within its range. All varieties are attacked at times and eaten. Still, it is quite likely that mice and large insects are oftener eaten than any other items. Aside from the variety of its food, the most astonishing thing about its diet is the comparatively large size of some of its captures, both mammalian and avian. For the pygmy owl is more savage and more courageous than many species of birds. Since it is a daylight hunting bird, its victims are such as would naturally be secured at that time. Mrs. Bailey (1928) says: "One taken by Mr. Ligon had its stomach packed with the flesh and hair of mice. * * * A Rocky Mountain Pygmy Owl taken by Mr. Bailey in Santa Clara Canyon at sundown had a meadow mouse in its stomach and gray fur in its claws. * * * One of the Pygmies was heard by Mr. Birdseye at night high up in the San Francisco Mountains, but three specimens taken by him on the Negrito and Frisco Rivers when discovered were sitting out in the broad sunshine, and the stomach of one was filled with grasshoppers, proving that it had been hunting in daylight."

Major Bendire mentions one that had seized a large pocket gopher; and I have already quoted his finding an adult Say's ground squirrel, fully twice the size of the adult pygmy, in a nest. E. L. Arnold (1932) says: "This afternoon [November 30, 1932] I found a pigmy owl apparently unable to fly. Upon investigation I found that he had a mole caught in his claws and was unable either to extricate the mole or rise with his burden into the air." This inability, or rather failure, of the pygmy, to release prey that seems too big for it has been noted also by other observers. There have been several instances where the rapacious little pygmy has been found dead beside its prey. Edward A. Preble (1930) writes: "Its powers can not be measured by its size, for it has been known to overcome ground squirrels of twice its [own] bulk."

While this subspecies does not seem to be so much of a bird destroyer as *californicum*, there are few birds smaller than twice its own size that it will not attack. As a rule it seems to grasp at least its avian victims by the neck. Edward A. Preble (1930) writes that "its standing with the small forest birds is indicated by the jeering, excited companies that gather when an Owl is discovered in its daytime retreat in some shady evergreen." Later on, under my subheading "Winter", I am giving several instances of pygmies preying on English sparrows. Major Bendire (1892) speaks of a pygmy "breakfasting upon a Western Tree Sparrow." H. C. Johnson notes that one Utah stomach was "literally gorged with English sparrows." Dr. J. C. Merrill, as quoted by Bendire (1892), says: "One captured February 21 had just struck at a robin and was struggling with it on the ground." H. H. Kimball (1925) writes that "Mr. Bently of Portal Ranger Station, Chiricahua Mts., Ariz., found a female Gambel Quail grasped by the neck with both sets of claws by a small owl, the quail still warm", January 21, 1925. W. L. Sclater (1912) says that one attacked "a Quail, and on other occasions it has been known to pounce on a Long-crested Jay and on chickens."

In spite of this destruction of small birds by the Rocky Mountain pygmy, so great is its appetite for mice, grasshoppers, and large insects generally, that it is classed by Dr. A. K. Fisher (1893b) as "beneficial in its ways and habits." Dr. W. H. Bergtold (1928), with many additional observations to help him to a verdict, says that it is "probably beneficial as a whole." Dr. Fisher lists lizards as a favorite food in some places. Major Bendire (1892) mentions one at Fort Klamath that occupied a willow branch over a stream for the purpose, he thought, of watching for frogs.

Dr. Elliott Coues (1874) speaks of the pygmy's fondness for insects. He says that specimens secured at Fort Whipple, Ariz., had their stomachs "filled with fragments of grasshoppers and beetles, some of which were yet scarcely altered by digestion, showing that they must have been very recently captured. Each of the birds was killed about noon."

Behavior.—When one reads through the literature about this owl, he is at once struck with the divergent views of the different observers. Dr. Coues (1874) gives us a very interesting early account of this bird on the basis of two specimens obtained at Fort Whipple. He says, frankly, that he is not very familiar with it, and he then gives a summary of habits as he surmises they will be found to be. How different this bird has proved to be from these early surmises! In the first place, although ornithologists most familiar with the pygmy say that it is common, it is astonishing how few are the actual references to it. Dr. H. E. Anthony writes me in the letter dated October 5, 1933: "I think that probably these little owls may be more abundant than most casual observers imagine because they may be in low trees and bushes and are mistaken, when they fly out, for robins, thrushes, or common species. When they are not flushed they sit so tight that the eye does not pick them up readily." Perhaps another reason for the pygmy's escaping general notice is its preference for the daylight hours. Of course, it is easier to see a daylight-loving bird; but one is simply not looking for an owl then, and so fails to recognize it. The first observers did not credit this owl with any diurnal habits but spoke of hearing it at night and of accidentally seeing it at dusk. It was not until several years had elapsed that its true habits were known. As a matter of fact, it is as daylight loving as most small birds are; but, like them, the Rocky Mountain pygmy is more active early in the morning and late in the afternoon. This subspecies is a lover of the forests, especially the pine forests of the mountains. And yet Major Bendire shot a female on "February 5, 1875, in the vicinity of Camp Harney, Oregon, at least 5 miles from the nearest timber. It was perched on a large bowlder lying at the foot of a basaltic cliff." But this was evidently an exception, rare with this bird. Because it lives in the coniferous forests, it is easy for this small owl to remain hidden, especially as it has the habit of sitting quietly upright on a limb, close to the trunk of the tree. Since most of its food is caught in the open, and about meadows, it is more often found in the trees near a sizable opening. In fact, I have no records of its occurrence in a heavy, dense forest, far from an opening of some kind.

Mrs. Bailey (1918) writes:

> It should be looked for mainly in the pines and on dead trees. Although diurnal, this tiny owl is more commonly seen at dusk or in the early morning in September or October around the border of the prairie patches on the west side of [Glacier] Park. Mr. Bryant writes: "On a fine sunny day the pygmy owl will often perch on the topmost twig of some tall larch, and morning and evening give a peculiar but pleasing sort of whistle." The white-headed lumberjack [or Rocky Mountain jay] "can mock them perfectly," he says, and he adds, "Many times when I thought I was about to collect a pygmy I have come face to face with the jack."

Major Bendire (1892) says there are "never more than one at a time." But Mr. Henshaw, as quoted by Major Bendire in the same work, "found the Pygmy Owls quite numerous in the southern Rocky Mountains, and states that they are rather sociable in disposition, especially during the fall months. He says he has imitated their call and readily lured them up close enough to be seen." In fact, this subspecies can be easily decoyed by imitating its call.

In the Yellowstone Park, I found pygmy owls tame, unsuspicious, and given to perching on the tips of low trees in semiopen places, on cold mornings at least. At such times, they seem to be enjoying the warmth of the rising sun. Then, there is nothing to indicate the bird's prowess as a hunter, nor the terror that it must often bring to a multitude of the smaller forms of life.

P. A. Taverner (1926) says: "An extraordinary and interesting little Owl. It is largely diurnal, and so small that one naturally expects it to have a gentle and unassertive disposition. This, however, is far from being the case. If the reaction of the small woodland birds to its presence is any evidence, this little raptor, no larger than many of them, must be one of their worst enemies. Its friends would call it courageous and determined; its enemies, ferocious and blood thirsty."

Mr. and Mrs. E. R. Arnold, of Yellowstone Park, had the good fortune to keep one for a few days in winter, and wrote in the mimeographed Nature Notes from Yellowstone Park: "This little fellow was quite friendly. * * * His demeanor was that of dwarf members of many families—decidedly pompous and self-sufficient. * * * When our old cat walked sedately into the room, the cat crouched low and 'froze,' all the time making nervous little sounds and the Pygmy turned his head so far around we felt he must wring his own neck."

The flight is not at all owllike but more on the order of the sparrow hawk, or even more like a shrike's. The pygmy watches from an elevated perch for prey below it and pounces down upon it. When going from perch to perch, it flies like a shrike, dropping from its perch, buzzing along just above the ground, and rising sharply to its new perch. Its flight is more noisy than other owls. Perhaps some of these peculiarities are due to the diurnal habits of the Rocky Mountain pygmy.

Voice.—The majority of the notes uttered by this pygmy are decidedly musical and hence not at all like other owls'. Most hearers have noted the resemblance of its commonest notes to the cooing of the mourning dove. My own experience has been that while the notes are short and repeated like a dove's, and there is at least a suggestion of the dove's rolling effect, still the pygmy's notes are somewhat sharper, and each note more distinct, than the dove's.

When Theodore Roosevelt and John Burroughs first heard one of these owls in the Yellowstone National Park, they could not at first believe that it was an owl. Roosevelt (1904) says: "We had seen a pygmy owl no larger than a robin sitting on top of a pine in broad daylight, and uttering at short intervals a queer, un-owllike cry." Burroughs (1906) wrote: "It was such a sound as a boy might make by blowing in the neck of an empty bottle." Mrs. Bailey (1928) says the note of an immature female "was a long whistle followed by a cuckoo-like *cuck, cuck, cuck, cuck, cuck.*"

The pygmy owl seems to be most vocal during the spring and early summer months, although a few individuals may continue throughout the summer. Dr. Mearns (1890) says: "Its pleasant note was heard in the pine-trees overhead nearly every night while I was exploring the San Francisco group of mountains." Major Bendire says the notes were heard "usually shortly after sundown." On the other hand, all other observers that mention the time of day say that the notes are uttered during daylight, preferably early in the morning or late in the afternoon.

Charles F. Morrison, of La Plata County, Colo., is quoted by Major Bendire as having heard only a faint squeak from this owl. Mr. Silloway (1903) says: "When flushed, they uttered a faint shrill whistling call. One of the family, the female in charge of the youngsters, uttered a low cooing whistle, in low pitch."

Enemies.—As a rule the small birds pay little or no attention to the presence of a pygmy owl near them; but there are a few recorded exceptions. Mrs. Bailey (1923) writes that "the little owl was being mobbed by bridled titmice." At a later date Mrs. Bailey (1928) says: "In the Sacramento Mountains Mr. Ligon has discovered two by the hummingbirds fighting them, and finds that the juncos also often betray the presence of the little Owl, perched knot-like, on a limb." C. A. Allen, quoted by Dr. A. K. Fisher (1893b), says: "There were fighting the Owl one pair of *Tyrannus verticalis*, one pair of Bullock's Orioles, one pair of Bewick's Wrens, three Banded Tits (*Chamaea fasciata*), one pair of *Pipilo oregonus*, one pair of *P. crissalis*, and about twenty Blackbirds (*Scolecophagus cyanocephalus*). The bravest birds were the Bewick's Wrens and Bullock's Orioles, which kept darting at the Owl's head as it sat on the ground devouring a young Blackbird."

I have myself several times found this little owl by investigating the wherefor of a screaming mob of jays; and Dr. Mearns (1890) has given another instance of this method of finding them: "It is more apt to be discovered by its spiteful little enemies, the Pygmy Nuthatches, than by ornithologists, and I am indebted to these little birds for most of my specimens. * * * Another captured at Banghart's Station, in Chino Valley, while surrounded by belligerent Plain Titmice in a cottonwood hedge."

Winter.—In winter the pygmy owl seems even more abundant in the Yellowstone National Park than it does in summer I then see these little owls, from January to May, on the tips of small cedars, or low limber pines, or dead lodgepole pines, all fluffed out into balls and apparently enjoying warm sunbaths. Usually, at such times, they face toward the sun. At intervals, especially when disturbed, they turn their heads this way and that with quick, nervous jerks. Generally they are very tame and permit me to ride my horse directly under them even when they are only a few inches above me in a low cedar. I have heard that it is easy under such conditions to catch the drowsy pygmy in one's hand, although I have never tried it myself. But Mr. Winson (1926a) writes: "On cold winter days in the sunshine it is possible to catch one 'napping', or so dull that by waving one hand in front of it to hold its attention, and bringing the other hand up from behind, it may be picked off its perch, furious and snappy."

Mr. and Mrs. E. R. Arnold (1930), of Tower Falls Ranger Station, Yellowstone Park, say: "During a recent three weeks stretch of subzero weather a tiny owl could be found almost any hour of the day, perched on a beam conveniently overlooking the grain bin in the barn. This little fellow was quite friendly and allowed us to take him into our kitchen once or twice when we—merely cold-blooded humans—considered 34 degrees below zero too cold for even a diminutive owl, clothed warmly in feathers from the top of his head to the sharp claws on his miniature feet. He was quite patient with us and allowed us to measure and photograph him, but he spurned some small pieces of raw meat." Soon the door was opened and he was allowed to fly back to the barn. Later in the same article they tell us that "it is a certainty that not a single mouse has been seen inside the barn since the departure of our interesting little guest."

Dr. Sclater (1912) tells us that the pygmy owls winter in the foothills and on the neighboring plains of Colorado, although often summering in the mountains. Dr. W. H. Bergtold (1928), also, says that although in the mountains in summer, they are more common on the plains of Colorado in winter. Norman deW. Betts (1912) gives an interesting item: "This small owl was fairly common in the city of Boulder from the first week of January to the middle of February, 1912. One bird was found dead and others were observed in various parts of the city; the number of individuals of course may not have been over three or four, as they were observed singly. On two occasions (at 8 A. M.) I saw this owl feeding on a bird about the size of an English Sparrow. They appeared to be active at all times of the day." In Utah the pygmy owls have acquired the habit of visiting at least the smaller cities. H. C. Johnson (1903) writes: "The capture of a pygmy owl in the streets of American Fork, Utah, a few days ago excited some interest but was not the first occasion of its kind. Two or three years ago I had one similarly caught (by a boy with his hands) and on dissection I found it literally gorged with English sparrows. * * * The bird is not uncommon among us in winter and is attracted in town by the most natural thing in the world—food."

DISTRIBUTION

Range.—Western North and Middle America; nonmigratory.

The range of the pygmy owl extends **north** to northern British Columbia (Doch-da-on Creek, "Second Cabin", and Willow River); and Montana (Sun River, Bridger Canyon, and the mountains near Red Lodge). **East** to (mountains near Red Lodge); Wyoming (probably Jackson); Colorado (Estes Park, probably Boulder, Ute Pass, and Wet Mountains); New Mexico (Willis, Santa Fe Mountains, Glorieta, San Pedro and Cloudcroft); Chihuahua (Colonia Garcia); Tamaulipas (Galinda); Chiapas (Comitan); and Guatemala (Choctum, Coban, and Volcan de Fuego). **South** to Guatemala (Volcan de Fuego, Duenas, and Panajachel); Guerrero (Omilteme and Vente de Zopilote); Michoacan (Mount Tancitaro and Patamban); Colima (Sierra Nevada); Jalisco (La Laja, Las Penas, Volcan de Nieva, and Guadalajara); Nayarit (Sierra Madre); and Baja California (Mira Flores). **West** to Baja California (Mira Flores, Sierra de la Laguna, and Comondu); California (Escondido, Pasadena, Carpinteria, Little Sur River, Santa Cruz, Nicasio, Mount Sanhedrin, Humboldt Bay, and Crescent City); Oregon (Fort Klamath, Elkton, Newport, probably Ocean Park, and Tillamook); Washington (probably Grays Harbor, Lake Crescent, and Bellingham Bay); and British Columbia (Cowichan Lake, Port Moody, and Doch-da-on Creek).

The range as above outlined is for the entire species, which has, however, been separated into several geographic races, or subspecies. The typical form (*Glaucidium gnoma gnoma*) occurs only in the mountains of northern and central Mexico, south to Guatemala (according to Griscom, 1932, typical *gnoma* is not found in that country, and he recognizes two local races, *G. g. cobanense* and *G. g. griseiceps*). The Rocky Mountain pygmy owl (*G. g. pinicola*) is found throughout the Rocky Mountain region from Montana south to southern Arizona and extreme eastern California; the coast pygmy owl (*G. g. grinnelli*) occupies the Pacific coast portion of the range from (casually) southeastern Alaska south to Monterey County, Calif.; the Vancouver pygmy owl (*G. g. swarthi*) is found only on Vancouver Island, British Columbia; the California pygmy owl (*G. g. californicum*) occurs from San Diego County, Calif., north to northern British Columbia, except for the humid coastal strip; and Hoskins's pygmy owl (*G. g. hoskinsi*) is found only in southern Baja California.

Casual records.—A specimen of the pygmy owl was taken near Calgary, Alberta, sometime previous to 1901, and one was reported as seen near Sedgewick on November 8, 1913. A specimen was collected on Dall Island, Alaska, on August 24, 1920, and there are several records for the vicinity of Wrangell. It seems probable that this owl may be a more or less regular resident of southeastern Alaska.

[AUTHOR'S NOTE: Frank L. Farley writes to me as follows: "That an incursion of pygmy owls took place, during the winter of 1932–33, into western Alberta is very evident. Francis Beebe, of McLeod Valley, obtained a pygmy owl on November 14 and another on December 17, 1932. Dr. William Rowan received two pygmy owls from Phoenix, Alberta, one on November 11, 1932, and another on January 10, 1933."]

Egg dates.—California: 10 records, April 24 to June 28; 5 records, May 1 to 19, indicating the height of the season.

Arizona: 9 records, May 19 to June 14.

GLAUCIDIUM GNOMA CALIFORNICUM Sclater

CALIFORNIA PYGMY OWL

PLATES 90, 91

HABITS

CONTRIBUTED BY MILTON PHILO SKINNER

California has a variety of the pygmy owl that is browner in color than the Rocky Mountain form. With reference to this browner form, Dr. Louis B. Bishop (1931b) has published a very interesting paper. He gives important data to prove his contention that *pinicola* is but the gray male and *californicum* is the browner female of the same subspecies. But, since I am following the latest A. O. U. Check-List, I am here giving a life history of each subspecies as it has been recorded up to the present time. The California form is not a dense-forest lover; but, on the other hand, it is not usually found very far from trees of some kind. In the humid coast region of northern California, this form is replaced by the coast pygmy owl. C. W. Michael, resident for many years in the Yosemite Valley, says: "One of the most interesting birds of the Yosemite Valley is the little pygmy owl. He is a tiny fellow, not much larger than the English sparrow. His head is round and without ear tufts. His yellow eyes have a wise and friendly look. His posture when perched is rather erect, and his tail appears very short. His white breast is marked with clear black pencilings, and his brownish gray back is checkered with small white dots."

Courtship.—One day, as Mr. and Mrs. C. W. Michael were watching a pygmy owl, they heard it give a long, trilling note. "Evidently this call was meant for the ears of his mate for almost immediately he was joined by a second owl. The birds snuggled together shoulder to shoulder in an affectionate attitude, and while in this position the burden carried by the first bird was passed to the newcomer. The second bird, which we took to be the female, at once proceeded to pluck the feathers from the vireo." Since this was on June 2, 1927, it was probably one of the last affectionate "snugglings" of the courting season. Two years later, on the morning of April 20, 1929, Mr. Michael saw another pygmy disappear into "a deserted woodpecker hole. As I stood waiting for the owl to reappear there came the familiar soft, fluttering trill of notes. Directed by the sound a second owl was soon located. This second owl was perched on a branch about ten feet from the nest hole. Again came the soft quaver of notes, and this time as if in answer to the message the bird in the hole poked his head out. After gazing about for a moment he left the hole and flew to the calling bird. On fluttering wings he hesitated over the perching bird and then settled gently to accomplish the supreme embrace. The perched bird received the caress without protest. The mating act completed, the male bird snuggled close to his mate in a most affectionate manner." All during this love scene nearby juncos and other small birds kept up a constant chatter of protest; a protest that was ignored by the courting pygmies.

Nesting.—In California this subspecies is found in the forests all along the Sierra Nevada. South of Santa Cruz it is also found in the coast ranges. It is not a resident of the great central valleys, nor of the desert ranges, although it is possible that it might occur on the highest desert mountains, if wooded. It nests almost exclusively in woodpecker holes if available, especially the old nesting sites of the California woodpecker. Mr. Michael tells me that all the nests he has found, except one, were in such holes. Under such conditions it might seem as if there would be more or less conflict between the two. On the contrary, they seem to get along well together, although other species of woodpeckers fight these owls. And the owls retaliate by eating both adult and nestlings of sapsuckers and woodpeckers, other than the California. As a rule this owl selects a site for a nest near a meadow, or opening. It is easy to account for this marked preference, because of the pygmies' preferred foods, mice and grasshoppers, that live in the open. Again, I have often been impressed with the scarcity of small bird life away from these openings, especially in the Sierra Nevadas. So even the small birds that are preyed upon during nesting time are then more numerous in the open meadows and in the thickets along their edges. Furthermore, the first food that will be hunted by the young is apt to be grasshoppers found only in the open.

Mr. Michael says: "The female does the incubating; the male does the hunting and brings in the food. When the male arrives with food he perches near the nest hole and calls to his mate in a soft wavering trill. The female comes forth, joins her mate, accepts his offering and retires to the nest hole to dine at leisure. Owing to the predacious habits of the pygmy owl, and to his success as a hunter, the immediate neighborhood of his nest always becomes destitute of small bird life. The bird student knowing his district well could almost sense the presence of the pygmy owl by the scarcity of small bird life. In justice to the pygmy, however, it must be admitted that he shows a strong preference for mice, except during his nesting season." Some of these Yosemite pygmies, at least, will nest in the immediate vicinity of houses. Mr. Michael writes me that of three nests found during the spring of 1927, one was directly across the road from his bedroom window. Although the majority of egg settings are complete before June first, only one brood is raised each year, so far as I know.

F. C. Holman (1926) speaks of a nest discovered in the Yosemite Valley on May 19, 1925:

> [The nest] was located in a cavity of a black oak standing within seventy feet of the highway and close to the LeConte Lodge. The entrance was about four inches in diameter, a circular hole some thirty feet from the ground, where the base of a small lateral branch had decayed away in a large upright dead limb The nest within was somewhere well below the entrance.
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> There was little difficulty in distinguishing the two birds of the pair, as the breast plumage of the female was of a darker shade, and her tail shorter, evidently worn so by the confines of the nest. As incubation was only then in progress, it would seem too short a period in which to be thus affected, and the fact might be taken to indicate an earlier nest. Later the tail acquired its normal length.
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> * * * He seldom went near the hole, and generally refrained from alighting in the tree, but called from a nearby oak grove, the lower fringe of growth that covers the talus slope from the cliffs. She often responded promptly from the hole, flying toward his general direction and, when definitely located, darting at him, seizing the offering in an apparent clash of wings, and either remaining to eat it or, as the case might be, carrying it back to the hole. Sometimes her exit would be delayed, obviously due to her inability to catch the sound [of his call], and occasionally she was obdurate and refused to appear.

Since Leo K. Wilson (1925) also describes a nest in an oak at LeConte Memorial Lodge, it is probable that it was the same nest, but he gives additional details. He said: "On June 10 the birds were under observation for a period of about three hours. During that time the male came three times to the nest hole with food for the setting female. * * * At the fourth trip the female refused to come to the mouth of the hole to receive the offering of the male. The male kept up an incessant calling, that, in spite of its low tone, could be heard for some fifty or sixty yards. After waiting about five minutes the bird flew."

J. A. Munro's (1919) experience in British Columbia is much like these in California, except as to kind of tree and size of brood, for he says: "The only nest I have found was in an old woodpecker's hole, thirty-five feet above the ground in a western larch. There were seven downy young in this nest. This was in a thick forest of Murray pine, Douglas fir, and western larch, where they were more plentiful than in the yellow pine stands at lower altitudes." This nesting note from Mr. Munro is the only one I have for this subspecies from that part of the habitat north of Fort Klamath at the Oregon–California line. No doubt this subspecies also nests in the central part of Washington and Oregon as well as in California.

J. C. Braly (1930) says: "On May 21, 1930, I was hunting * * * near Fort Klamath, Klamath County, Oregon. While passing through a grove of unusually large quaking aspen trees at the edge of the marsh, I noticed an old flicker excavation about twelve feet from the ground in one of the largest aspens. Upon striking the tree, a Pigmy Owl (*Glaucidium gnoma californicum*) flushed." This nest seems to have had the largest opening of any, except the one described by Messrs. Holman and Wilson, and it is notable also for its nearness to the ground. An account of a nest found by George H. Ready, in a poplar [probably a black cottonwood] is given by W. A. Cooper (1879) as occurring "two miles from Santa Cruz on the San Lorenzo River." This nest, unlike those previously noted, was not in the mountains, but was comparatively near the Pacific Ocean and not high above it. O. W. Howard, as recorded in the Nidiologist, vol. 2, p. 153, also, found a nest near the ocean at Carpinteria, Calif., but gives us no clue as to its height above sea level. Mr. Howard's nest, found in the summer of 1895, was especially interesting because it was "in a hollow sycamore tree, six feet from the ground."

George Willett (1912) gives an account of another nest in a sycamore, found by F. S. Daggett, that was maintained for at least three seasons prior to 1896, near Switzer's Camp in the Arroyo Seco, Los Angeles County. While Switzer's is actually in the mountains, the altitude of this location was probably not very high. This record is interesting, for it indicates that these pygmies sometimes nest for several successive seasons in the same hole. Another lowland nest was recorded by Mr. Sharp (1907): "A pair of these diminutive owls were found nesting at Escondido by the late J. M. Hatch in 1895 and 1896. The nests were in oaks not far apart both being in hollow, nearly horizontal limbs with openings allowing access to the nest from either side." The eggs were well incubated and hence were not disturbed. "Mr. Chas. Schnack who was with Mr. Hatch when the second nest was found tells me the owls had a curious trick of flattening themselves out on a branch so that it was almost impossible to tell them from the branch itself." Mr. Swarth (1910a) writes of a nest from southern California, found on June 28, 1894, this time in a dead pine in Bear Valley, and probably another in a yellow pine, in the San Bernardino Mountains.

While all the several nests in the Yosemite Valley were in oak trees, and there are records of nests in oaks in other sections, it is evident that California pygmy owls may nest in several different kinds of trees. They nest at altitudes varying from sea level to 6,000 feet above, and mostly in the Transition Zone, with a few in Upper Sonoran Life Zone. The average height above the ground is 40 feet, although varying from 6 to 75 feet.

Probably the list of nests observed by myself and by other workers numbers as many as 50, but in only one case has nesting material been observed and mentioned. George H. Ready, as quoted by W. A. Cooper (1879), speaks of "stirring up the nest which was made of twigs." Still, he does not say that the twigs were actually placed there by the birds. The nest holes examined by myself often contain parts of leaves, pine needles, and trash, but I think this material, which has never been abundant, merely falls there accidentally as I believe is the case with the Rocky Mountain subspecies, also. Some of it may have been carried into the nest by adhering temporarily to the pygmies' plumage; but I have never seen, nor heard, of any nesting material intentionally carried into the hole by the adults.

Eggs.—The average number of eggs in a clutch, for this subspecies, is three or four; but J. A. Munro, as already quoted, found seven young in one nest. J. C. Braly (1930) says that on May 21, 1930, in his Fort Klamath nest, there were "six beautiful white eggs, slightly advanced in incubation." Apparently eggs are laid from May 5 to shortly after June 1, and incubation starts immediately after the first egg is laid. The eggs are white, short oval, and probably approach a sphere as closely as do the eggs of any American bird. So far as I know from my own experience, they are never tinted or marked in any way; but Oliver Davie (1889) says that Ready's Santa Cruz eggs had a "scarcely perceptible yellowish tinge." Actually they are much like the eggs of the mourning dove, although a little larger.

[AUTHOR'S NOTE: The measurements of 24 eggs average 29.6 by 24.3 millimeters; the eggs showing the four extremes measure **31.5** by 24.5, 30.9 by **25**, **28** by 24, and 30.7 by **23.3** millimeters.]

Young.—Since incubation apparently begins with the laying of the first egg, the emergence of the owlets may be spread over a day or two. In the Yosemite Valley, where I became acquainted with this subspecies, the first young pygmies hatch about May 25. They are blind, helpless, and almost naked. Like so many other very young birds, they seem all head and stomach, with a thin, scraggly neck connecting the two. The mother bird removes all egg shells and undesired debris from the nest. During the time that the young remain in the nest, and for a short time afterward, she does most of if not all the feeding; while the male parent brings food to the mother for both her own use and for the owlets. At first most of this food consists of small birds; later, mice and other small mammals are added. Dr. H. C. Bryant writes me in a letter dated October 7, 1933: "One outstanding memory is that of a parent standing on a limb near the entrance to the nest, holding a fence lizard. When this bird felt that all was safe, it entered the nesting cavity, carrying its prey." The nest referred to was in the Yosemite Valley. As a rule the male bird decapitates and partly skins the food before passing it over to the female. After the young have been fed inside for about three weeks, the mother sometimes coaxes them out on a limb to eat. At first, they remain more or less quietly on the limb; but, after they have acquired more confidence, they move along the limbs, or hop from one to another. A few days of this and the owlets begin to try short flights. During early flights, they may miss the desired perch. In that event, they alight lower down, and then scramble back up limb by limb.

C. W. Michael, with exceptional opportunities to watch pygmy owls, tells me that "when the young come along the male continues to do the hunting, and while the young remain in the nest he usually brings in small song birds. As the young grow more vigorous he brings in more substantial food, in the form of lizards, chipmunks, and field mice. It is an interesting sight to see a mother pygmy owl perched on a limb and surrounded by her young, encouraging each in turn to tear off a bite of meat from the chipmunk she holds in her talons. The pygmy owls nest early, and the young birds are usually ready to leave the nest by the first or second week of June." On one occasion, when the male had passed a vireo to his mate, "she held the body of the vireo under her feet and then reaching forward she plucked the large feathers one by one. For ten minutes she was very busy, and there was a constant rain of feathers drifting down from her perch. While plucking feathers she appeared also to be mauling and beating the body. Finally when the feathered morsel was properly prepared she flew to another oak, and, as we watched, she disappeared into an old woodpecker hole drawing her burden in after her. And then there were squeals and squeaks as though a family of vigorous young were fighting for their breakfast." On "June 5 we were again at the pygmy owl's nest. The nest was silent and nothing was seen of the old birds. A little after nine there came the faint, fluttered notes that announce the arrival of a bird with food. The notes seemed to come from a nearby oak, but nothing was seen of the old birds. So far as the owls themselves were concerned this completed the record for the morning. The conclusion was that the young owls had grown up and had abandoned the nest on this hot day, but were still being fed in the neighborhood."

In another nest in the Yosemite, the owlets were much later in leaving the nest. F. C. Holman (1926) says of this:

> The first evidence that the young were receiving solid food was on June 10 [1925], when the female carried a lizard to the nest. As far as observed, the male never took part in feeding the young. No pellets or refuse of any kind could be found under the tree.
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> On June 21 a young bird appeared at the opening, and it was soon apparent that there were no others. From that time on to July 1, when the nest was deserted it sat daily at the entrance. During the following days the bird remained near at hand, and gradually worked up the talus slope. The young bird appeared from the first fully developed, with no immaturity noticeable in the plumage. It was never fed at the entrance, but was first crowded back out of sight by the mother. On one occasion when she was away, and the young one sat there as usual, the male arrived with food and alighted in a neighboring tree. The young bird showed no recognition of the frequent calls; in fact the two acted as though oblivious of each other, and nothing took place during the half-hour they were under observation.

Dependence on the adults for food does not last long. Soon after leaving the nest the young, probably taught by the parents, learn to catch grasshoppers in the meadows. From that point on their hunting gradually extends to larger and larger game as the young owls get older, stronger, and more skillful.

Plumages.—The first plumage of this subspecies resembles that of the Rocky Mountain form. Mr. Dawson says that: "Immature birds are darker and reddish brown above; the tone of the head is grayer, inclining to slaty, in decided contrast to back; spotting much reduced, nearly confined to forehead and wings." Since what little difference there is between young and adult is not ordinarily capable of detection in the field, Mr. Dawson probably had specimens in hand for comparison in order to make the above distinction. H. S. Swarth (1910a) speaks of three young birds secured June 28, 1894. "The young birds have lost the natal down, except where a few filaments cling to feather tips, and are in the juvenal plumage, but with stubby wings and tail. The body plumage is much as in adults, but the top of the head is plain drab gray, in marked contrast to the brown dorsum, with a few partly concealed white spots on the anterior portion. There are some slight, apparently sexual, differences observable. The two young females are of about the same size, and are appreciably larger than the male. In the former the brown of the upper parts is of a more reddish cast, approaching Vandyke brown, while in the latter it is darker, more nearly Prout brown." It is not known just when the adult plumage is assumed. Probably, as with the Rocky Mountain pygmy, the change is gradual. Still, I think the changes all take place before the first winter begins.

There is one notable peculiarity of the adult plumage called to my attention by Mr. Michael when he told me of watching one of these owls one winter day. "With a lightning movement he would turn his head halfway around, presenting the back of his head to us. And as we watched this wonderful head, which appeared at times to turn completely about, we got the impression that the owl was double faced; for when he turned away his face we saw a second face on the back of his head—a white beak and closed eyes under beetling brows. Close scrutiny showed this beak to be a white feather and the eye brows and eyes produced by an arrangement of feathers. Nevertheless, this make-believe face was a very good one, and we wondered if nature had bestowed this second face upon the little owl to fool his enemies. With two faces the pygmy owl can really look one way while appearing to look the other way. Neither his enemies nor his potential victims can be sure just which way he is looking, all of which is to the advantage of the blood-thirsty little demon. He is like the teacher who hides his eyes behind dark glasses—the scholars can never tell just which way those eyes are looking."

Food.—Mr. and Mrs. Michael have studied these little owls so much that I cannot do better than give their experiences here, although some of this material has already appeared in the Yosemite Nature Notes: "We first became acquainted with the pygmy owl during the winter of 1920–21. We camped this winter on the south side of the valley in the shadow of the great south wall, and naturally our daily rambles often took us across the valley to the sunlit slopes about the mouth of Indian Canyon. Our favorite spot to eat lunch was at the base of a great yellow pine that stood back of the government barns. This too was the favored section of at least one pygmy owl and for a reason. During the day wide doors in the loft of the barn stood open and beyond these doors was food in plenty for the Pygmy. Life was easy for the little owl for whenever his appetite stirred him to activity he could glide through the open barn doors and choose a mouse to his liking. More than once we saw him dive into the barn and always he soon appeared with a mouse in his talons. From the human point of view the mouse is a destructive agent, therefore the pygmy owl as an expert mouser is a beneficent bird. But, unfortunately, the pygmy owl does not confine his murderous attacks to mice alone; he also has a taste for song birds. Twice we happened to see Pygmy strike down and carry off a Sierra junco, and once we saw him skillfully pluck a pine siskin out of the bare branches of an alder tree. While we were gazing up into the branches of a tall Kellogg oak, a willow woodpecker flashed into our range of vision. Our eyes naturally followed the woodpecker, which flew to a nest where he fed the occupant without entering the hole. This action would indicate that either the young were well grown or that the female bird was being fed by her mate. The woodpecker flew away at once, and we sat down to await his return that we might learn whether or not young birds were being fed. We had not long to wait. In less than a minute a strange bird flew to the nest hole. At first we were puzzled; the new arrival appeared to be struggling to get into the hole. Soon, however, we realized that he was tugging violently in an effort to withdraw his head from the hole. The struggle continued. There was no sound. Perhaps a minute passed and then the bird withdrew his head and in his bill he held a woodpecker. With the limp body of his victim he fluttered down to a lower branch. Now perched on the branch with the victim held in place by strong talons, the pygmy owl (for this the bird proved to be) proceeded to tear away feathers from the throat, apparently to make sure that his victim was dead, for in a moment he flew to another perch, this time carrying the woodpecker in his talons. Soon he flew a little farther and attempted this time to gain a toe-hold at the entrance of another woodpecker hole. His burden was too much for him (the woodpecker was almost as large as the owl), and he was forced to flutter down to another perch. Here the owl rested a moment, took a new grip on his victim, and flew upward into the cedar boughs opposite the nest hole he had so recently visited. Now he managed to cling to the rim of the hole, and going head first he did contrive to drag the dead woodpecker after him. Having had a good look at the victim we were inclined to believe that it was a young male willow woodpecker, full-feathered and about ready to leave the nest. So far as we could tell the parent woodpecker on returning did not discover his loss, at least he made no outcry."

Another time a pygmy was found surrounded by Sierra juncos. Apparently he had just caught a mouse on the ground and killed it. When the owl flew up to a blackberry branch, "the juncos followed and, ringing him as before, pelted the owl with emphatic words. When the owl remained motionless for two minutes the abusive chorus subsided to a few clicks. Heartened by the near silence the owl plunged his face into the skull of his victim to gnaw at the brains. At his movement the junco chorus became as loud as ever, and the owl paused and looked sharply about. After 15 minutes of this play the juncos seemed to have enough and the greater part of the flock took flight, only a handful remaining to hector the owl, and these soon followed their mates. Left in peace the little owl pulled the mouse from a blackberry thorn upon which it was impaled and, flying to the ground, resumed his epicurean feast. That it is the custom for many creatures who prey upon field mice to eat only the head, we know, as we often come upon the headless torso of a mouse during our rambles about the valley."

On June 2, 1927, the Michaels found another pygmy: "That bloodthirsty little owl that hunts his prey in the broad light of day. In his talons he held the prostrate body of a vireo. Carrying his victim, in a series of short flights, with pauses to rest between, he worked his way upward into the topmost branches of a tall Kellogg oak. When he reached the summit branches he paused again, and then we heard a series of high-pitched whinnying notes carried along on an even tone and so rapid that they seemed to vibrate. This trill was much like the trill call of the Sierra chickaree, only softer and lighter." This was evidently a call, for the female owl soon appeared.

Still another pygmy, seen one cold gray morning in April, had a mouse clutched close to the perching limb: "The tail and lower limbs of the mouse hung down and the owl was leisurely tearing the skin from its head and shoulders. Soon the pygmy was ripping into the flesh and from time to time he raised his head and appeared to smack his lips over a bloody morsel. The little owl controlled his appetite; he did not appear ravenous but ate slowly in the manner of a gentleman, with many a pause between bites. Twice during his meal he uttered softly a single hollow note, and we wondered if his mate might not be within hearing, possibly tucked away in her chosen nest hole. Nothing, however, was seen of the mate, and when we finally left the neighborhood the little killer dozed, with the remains of his victim still clutched tightly in his talons." In these accounts it will be noted that the pygmy does not swallow hair, feathers, and bones; and there is therefore no indigestible material to be expelled as pellets so characteristic of larger owls.

No doubt many of us have, like the Michaels, been introduced to pygmies by their mouse-catching. Mr. Dawson (1923) gives a particularly interesting account: "All at once the bird whirled backward and launched himself, like a bolt from a crossbow, at a mouse some sixty feet away across the road. Seizing the 'wee, timorous, cowerin' beastie' at the very entrance of his hole, the bird maintained its grasp upon it with both feet, and supported itself against the rodent's struggles by wings outstretched upon the ground. Not until the squeakings of the victim had quite ceased did the captor rise and disappear by rapid flight into the wood." Similar to the Rocky Mountain pygmy, this California pygmy often pounces on rather large mammal prey that drags its captor along with it before succumbing to the onslaught. This interesting habit is hinted at in the last quotation, but it is even better brought out by Major Bendire (1875):

> Sergeant Smith shot it today [December 14, 1874], while he was out hunting on the mountains north of the camp. He caught it in the act of trying to get away with a large sized wood-mouse, or gopher. The mouse was on the end of a pine log, when the little owl suddenly dropped down on it, out of a pine tree standing close to the log, in which it had been sitting, about twenty feet from the ground, and fastened its claws in its back. The mouse ran nearly the length of the log, about twenty-five feet, carrying the owl on its back, the latter appearing perfectly unconscious about where the mouse was going with her, keeping her head turned in the opposite direction. The time occupied in getting to the other end of the log took nearly two minutes. * * * The unconcerned, business-like manner in which the owl allowed itself to be carried by the mouse till the latter should be pretty well exhausted, before killing it outright, shows that this was by no means the first it had caught [in this way].

One interesting fact, already given in the Michael quotations, is that the pygmy does not always consume all its larger prey. Mr. Wilson (1925) writes of this with reference to a snake. He says: "The tit-bit, which in this case was a small snake about a foot in length, was carried in the bird's talons to the new position [in a pine 30 feet from its nest] * * * The owl began to tear the snake to bits, holding it in the meantime with its talons while it tore the flesh with its beak. Without finishing the animal, it suddenly flew off towards the rim of the valley, leaving the half-devoured body of the snake hanging on the limb of the pine." David D. Keck (1925) tells of a chipmunk that was partly eaten: "This owl was varying the customary fare of mice and reptiles with a full-grown Tahoe Chipmunk. The victim was half eaten when we approached, but the diner dropped the remainder and, giving us a resentful survey, flew away to a more secluded place." Ernest D. Clabaugh (1933) gives us a few additional items on the pygmy's fare: "A California Pygmy Owl when collected was found to have in its claws, a freshly killed Cassin Purple Finch (*Carpodacus cassinii*), of which the head and part of the entrails had already been eaten."

But the Michaels go a step farther and not only speak of the pygmies eating the head first, but also record a distinct habit of storing away food for future use. They say: "A mouse at a meal was too much for him, and yet with mice to be had for the taking he would not waste what he could not eat. After eating off the head and shoulder of the mouse he would carefully store away the hind quarters in some secret niche in the neighboring wood. These stores we believe were put away against the emergency, and we doubt if he ever fell back on these stores while fresh kills were to be made. Another incident tending to bear out the theory that the pygmy owl does not always reclaim his cache came to our notice recently. It was on the morning of November 29; we had wandered down the valley to learn what birds were present after the severe storm. As we moved along a bear trail close to the river a glint of blue in the underbrush caught our eyes. Perched silent and motionless were two blue-fronted jays. They appeared to be gazing fascinated at some object hidden from our view. We moved forward and a pygmy owl rose from the ground carrying with effort a full-grown meadow mouse. The owl came to perch on a low branch a few feet away. The jays followed, still silent, and alighted within two feet of the owl. Now the strange thing about the whole affair was the behavior of the jays. Usually when jays, or for that matter other kinds of birds, discover an owl they at once set up a great commotion, attracting all the birds of the neighborhood, and with the coming of the birds a mob scene is enacted. We concluded that the jays knowing that the owl could not consume the mouse at one sitting, were waiting for their share of the spoils."

F. C. Holman (1926) gives us a fine summary of the food habits of a nestful of pygmies in the Yosemite Valley, saying:

> Between the day the nest was discovered, May 19, and July 1, an interval of forty-three days, nineteen identifications were made of the food material brought by the male and received by his mate. The list consists of eight lizards, five birds, and six small mammals, apparently mice. While this may represent fairly the main diet, it should be borne in mind that our occasional inability to recognize the prey was particularly applicable to smaller objects. The lizards were easily distinguished with their long dark tails hanging down behind the owl when at rest, and even more conspicuous when in flight.
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> Of the birds, the first to be recognized was a warbler, probably a female Calaveras, and later, on June 19, a male Calaveras was carried into the hole. On the 27th a fledging of some small kind was noted, and on the following day, another of a larger species with noticeably long legs, and too immature to have left its nest. * * * The male was dedicated to the chase and would leave immediately after delivering his plunder. Naturally his arrivals were extremely irregular. The best record noted was on June 7 when, besides an early call, he brought in between 7 A.M. and 2 P.M. two lizards and two mice.

I have before me the analysis of 10 stomachs, taken at all seasons of the year and at several well-scattered localities. In general, they confirm field data already given in this article and show that although small birds may be freely caught during the pygmies' nesting time, during the remaining nine months of each year food is largely insects, small mammals, lizards, and even small snakes.

As to the economic status of this subspecies, we find the statements of W. R. Lord (1913) and a few others that it is actually beneficial. I have no accounts of poultry killing, and Mr. Lord (1913) says it is "altogether harmless in respect to poultry." No doubt the California pygmy owl can kill small game birds, but as yet direct evidence is lacking. The worst charge against it is that it eats valuable small birds. This is attested to by Baird, Brewer, and Ridgway (1905), Bowles (1906b), Dawson (1909), Munro (1919), and Taverner (1926). Their statements, however, are general ones, and may in some cases be repetitions of each other. Among the small birds (summarized from quotations already given) known to be caught are marsh wrens, sparrows, juncos, kinglets, purple finches, Calaveras warblers, towhees, Tolmie warblers, willow woodpeckers, vireos, blackbirds, and pine siskins. Summing up all available information, we may say that the food habits of the California pygmy owl appear beneficial during nine months of the year, but the record is marred by extensive small-bird killing during the other three months. Until more damaging evidence comes to light, the accused should be given the benefit of the doubt, and not be condemned.

Behavior.—This small owl has a well-earned reputation for courage, fearlessness, and fine hunting ability. Many ornithologists even go so far as to speak of it as "bloodthirsty", "a fiend", "a villain", and "rapacious." But it would seem better to reserve such severe terms for an intentional evil-doer. I do not know that any one accuses this owl of killing more than it needs. When it finds its prey, it strikes quickly and fearlessly. It does not cause needless suffering. As Mr. Michael says: "He lives by the law of Nature. Every living thing lives at the expense of some other living thing. In many forms of life the process is roundabout; in the case of the pygmy the step between victor and victim is quite direct. Should there evolve a form of life devoid of enemies, this form would sooner or later crowd every other form from the face of the earth. This scheme of Nature in having one form of life live at the expense of some other form is the process employed to maintain its balance. And in this balance each form of life has its place in the scheme of things, its particular niche to fill."

As with the Rocky Mountain pygmy, the California form was not at first recognized as a daylight species. But Mr. Michael says that his "observations over a number of years in Yosemite Valley seem to indicate that the pygmy owl is a bird of strictly diurnal feeding habits." F. C. Holman (1926) says: "There was nothing to indicate any nocturnal activity of the owls; in fact during the three months from May 1 to August 1 not a single call at night was heard. An early call soon after daybreak was not uncommon, and the last was never later than at dusk. During the latter half of June, the female spent much of her time in the trees near the nest, often roosting on a certain high dead branch." On the other hand, there are several reputable observers who state they have heard pygmies as late as 10 o'clock, at least.

After eating its food, the pygmy often selects a prominent perch in the sun and grooms itself as carefully as any other small bird would. It may even doze while taking its beloved sunbath. I have heard some arguments that, if this owl be diurnal, it would not sleep in daytime. But I think that this is going too far, and that this owl does nap at times during daylight. This may occur at any time of the year. The sunning perch may be at the top of living, or dead, trees or bushes, at heights varying from 6 to 30 feet. In winter, when such trees and bushes are free from leaves, the pygmy may select a sunning perch within the branches of willows, sycamores, or other deciduous trees. While I am not positive about the matter, I believe that these pygmies roost at night in otherwise unused woodpecker holes, even during summer.

Mr. Dawson (1923) gives some interesting data on these owls:

> Save to the few initiates, a meeting with this fascinating little fiend must come as a happy accident. Fiend he is from the top of his gory beak to the tips of his needle-like claws; but chances are you will forget his gory character at sight and call him "perfectly cunning", just because he is tiny and saucy and *dégagé*. Look your fill when fate brings him your way, for like the wind, his royal owlets flitteth where he listeth, and you cannot tell whence he comes nor whether he will come again this twelvemonth. When my moment of privilege came, this pocket edition of the powers that prey stood out boldly and unequivocally upon the topmost splinter of a wayside stub in a northern forest, and challenged attention. The gnome gave his back to the road, and now and then teetered his tail, which was otherwise set at a jaunty angle, nervously, as though there was something on his mind. But this preoccupation did not deter the Owl from bending an occasional sharp glance of scrutiny upon the birdman.
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> * * * We never should have noticed him if we had not been looking upward, intent on early pussy willows, amongst which he sat, calmly, at the height of a dozen feet. There is always a curious impersonality about the gaze of this little owl. Even when he does look in your direction (and he does not flatter you by constant attention by any means), he does not appear to focus on you at all. Perhaps this is a trick of the eye, or else arises from its unlikeness to that of other owls. For although the atmosphere on this occasion was full of light, the bird's pupils were dilated to the utmost, and the irides were mere yellow rims.

In spite of its usual boldness and fearlessness, this pygmy owl is cautious at times. H. C. Bryant says that a parent with a fence lizard paused at the nesting tree and looked around carefully. It did not enter the nest until it had satisfied itself that there were no enemies in the neighborhood.

As is the case with the Rocky Mountain pygmy, this subspecies has the flight of a shrike, with the same peculiar wing beat. Its speed is fair. The flight sound is not muffled by softened wing linings but resembles that of an ordinary bird in this respect. Like the shrike, it is apt to fly by a series of short flights with resting pauses at favorite lookouts. After alighting it may work itself up through the tree, limb by limb, to a higher branch, or even to the top. Although the flight in other respects is not owllike, a pygmy has the usual big-headed appearance of other owls. On August 26, 1933, I saw one in the Sequoia National Park early in the morning. It was flying about 20 feet above ground, and this particular bird reminded me somewhat of a large flying bat. I have also heard it said that this flight resembles that of a falcon. With all these comparisons, it is small wonder that the pygmy is deceiving and that it is less often recorded than its common occurrence justifies.

On November 16, 1925, Joseph Grinnell, Tracy I. Storer, Joseph Mailliard, Eugene Law, and Mrs. Law were gathered at Mr. Law's home in Altadena, Calif. There they saw such an unusual sight that I think it deserves quoting. Joseph Mailliard (1926) says:

> A few feet below us and some ten feet away was the bath—a shallow Indian mortar—beneath a bush. The pigmy owl (*Glaucidium gnoma*, subspecies *californicum* in all probability) was thoroughly enjoying itself, unconscious of the group of fascinated watchers. The owl was wading about in the water, which was not over an inch and a half deep, sometimes ducking its head and then shaking off the water that rolled down its back, then again dipping forward so as to bathe its abdomen and breast. At times it would slowly turn around, seemingly not quite decided just what to do next, or it would stand still for a few seconds and then switch its tail sideways in the water with a remarkably quick action. Once it stood still with its back toward us for some little time, now turning its head on one side until looking directly backwards, then snapping its head around anteriorly to the other side until the posterior limit of action was reached, all with such rapidity that our eyes could scarcely follow the movement. During this time, some five or six minutes, the owl kept its feathers so fluffed out as to make it appear to be much larger than it actually was.
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> Meanwhile, in timid wonder, there was gathered around the bather another group of spectators—Valley Quail, Anna Hummingbirds, Gambel Sparrows, Golden-crowned Sparrows, Spurred Towhees, Anthony Brown Towhees, Audubon Warblers, Pallid Wrentits and possibly other birds, all in characteristic attitudes watching the proceedings with suppressed excitement, with the hummingbirds poised on wing in front of the bath.
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> Finally, apparently deciding that it had done its duty in the ablutionary line, the little owl flew up to a bare branch three or four feet above the water and perched there, wagging its tail from side to side, possibly to shake off any remaining water. In about half a minute it flew into the upper part of a large oak tree near by, where it remained for some minutes before finally flying over and pitching down the edge of the bluff behind the house, followed by some twenty of the avian observers of its recent bathing activities.

Voice.—Mr. and Mrs. Michael have been very generous with material on the pygmy's notes and calls. Early in the morning of a May 4 they "caught the single hollow whistled note of an owl. The sound seemed to come from directly overhead." On the morning of June 2, 1927, they found a pygmy hopping up to the topmost branches of a tall Kellogg oak, where it gave a trilling note. Another time they speak of a single note given while eating as recorded herein under notes on feeding. Of another occasion, they say: "The song of the Pygmy Owl is a series of mellow notes, rolled along at an even pitch. The first stream of notes comes rapidly in a sort of a low rolling trill. Then comes a pause and three notes each separated by a distinct pause. In print the song might be represented as follows: *o-o-o-o-o-o-o-o-o-o----------oo---------oo---------oo*. The characteristic feature, the touch that gives charm and beauty to the theme, is those long hesitating pauses between the last three notes. There is also a ventriloquistic quality to the voice of the pygmy, and the least turn of his head apparently changes his location. Therefore a singing bird is very hard to locate, for his song comes from one direction and then from another direction." The song just described seems to be the standard vocal effort of summer, and perhaps it may be used at other seasons also.

Grinnell and Storer (1924) describe this same song when they write:

> In the Yosemite Valley, the voice of the California Pigmy Owl was heard more frequently than that of any other nocturnally active bird. * * * A regular concert beginning at early dark and lasting until dark, [was] given on the evening of October 10, 1914. * * * Two birds about 300 yards apart were answering one another, and at one time a third was heard in the distance. The calls consisted of a slow trill, rather mellow, but not so mellow nor of such full quality as in the call of the California Screech Owl—more like the slow roll of the flicker. This trill would continue some seconds, then came a pause, then one note, an equal pause, and a second note. In one instance a third note was added. The striking characteristic was the pause after the trill, followed by the two detached notes. Once three far-separated notes were heard, not preceded by any trill. The following syllables, if uttered while one whistles, seem to represent the pigmy owls' usual song: *too-too-too-too-too-too-too-too; toot; toot; toot.*

Mr. Dawson gives still another description in his Birds of California:

> The Pygmy Owl "sings" in a small hollow voice, *klook-klook-klook look look look look look look*, with an effect for tempo something like that produced by the accelerating rebound of a tiny wooden mallet, struck on resonant wood, in quality something between this and the pectoral quaver of the Screech Owl. * * *
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> Even more characteristic of the bird's presence in the forest is a weird, tolling note, ventriloquial, elusive, and most marvelously penetrating. At some distance it meets the ear as a mellow rounded *tŏŏk* or *tŏŏŏŏk*, for it must not be conceived too short, nor yet as other than a monosyllable. At close quarters, however, one detects a premonitory sibillation, and at the end a gurgling, muffled ring. The whole becomes then *(si)poolk(ngh)*, and it may be best imitated by a whistle which is conscientiously modified by attendant grimaces. Nor is it easy to exaggerate the penetrating character of this sound. When I first ran it down,

> I left camp with the expectation of encountering its author somewhere within a hundred yards. I followed the siren call through a fringe of woods, across a bit of prairie, through a swamp, over a wooded hill, and into the depths of the forest beyond, where, at the summit of a grim fir tree, at a height of two hundred feet, and at a distance from camp of *more than one mile*, I made out the instigator of the pleasant exercise. * * *
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> Coming south for the winter of 1912–13 Mr. Brooks amazed us by his mastery of this woodland cry * * *. Not only will the Owls themselves respond to the cry and hurry forward, astonishment and perplexity written in every line, but all the song-birds rally also. It is the master call of the woods, as effective in California as the Screech Owl quaver is in the East.

J. A. Munro (1919) also comments on the pygmies answering an imitation of their notes. He says:

> This is the easiest of the owls to call. They will come readily at any time of the day, and from long distances to an imitation of their call. They approach the caller with short flights from one tree-top, to another slightly nearer. When in a tree directly over the caller's head, a further call will bring them down to the lower branches, often within a few yards. Often two or more will come from different directions. * * * They are usually followed by an excited crowd of Chickadees, Nuthatches and other small birds, and keep darting at the owl as long as it is in the open. When answering the call, they usually sit in a conspicuous position, at the top of a tree or on a dead branch.

Lyman Belding compares the note of the California pygmy owl to that of the yellow-billed cuckoo with which he was very familiar. Charles W. Bowles (1912) speaks of an observed difference in the notes of the two sexes, the male's note being a very high pitched, staccato affair, the female's being similar but lower, softer, and more liquid. F. C. Holman (1926) gives some additional particulars when he says: "The only note of the female [at a Yosemite nest in May–June 1925] was a soft twitter used indiscriminately, as when in protest to noisy pugnacious neighbors or when on the wing flying to her mate in response to his summons. His call invariably announced food, and was the well known whistle of a single note given three times, rarely four, and the interval before repeating, of variable duration, extending into minutes. On one occasion only was the long trilling call heard, and possibly it might have come from some other member of the tribe."

Fall.—Although the California pygmy owl is ordinarily a resident throughout its range, it does sometimes make considerable movements in fall. Wyman and Burnell (1925) say that this subspecies is "at lower levels in winter" than in summer. But I think all these movements are sporadic, rather than regular, and that they are only indulged in by certain individuals, or during exceptional weather. If this idea be true, we can hardly call these pygmies truly migratory.

Enemies.—Throughout its range the California pygmy is subject to the tormenting and "mobbing" of gatherings of all sorts of smaller birds. For instance, Mr. and Mrs. Michael tell of a nest in the Yosemite Valley found during the spring of 1927: "When the owls began to bring food to their young a number of robins that lived in the vicinity kept me informed as to their goings and comings. Loudly the robins, and very often they were joined by other birds, protested the arrival of the owls." Another time, on the morning of April 20, 1929, Mr. Michael's attention "was attracted by the evident excitement among a mixed gathering of small birds. Sierra juncos were uttering their scolding 'click notes' and California purple finches were protesting vociferously, while three or four California woodpeckers looked on with but a mild show of interest. Sure enough, as was suspected, the birds were berating a pygmy owl that was perched in the bare branches of a Kellogg oak. While I looked on, the owl took wing, and with a dozen or more small birds in close pursuit it flew a hundred yards and again came to perch in a Kellogg oak." Summing up his experiences, Mr. Michael says that "all small birds hate the pygmy owl. When a pygmy is discovered all the small birds of the neighborhood band together and do their combined best to make his life miserable. They curse and revile him, but do not dare to strike; a bird with two faces, four eyes, and a fighting heart is a little too tough to tackle."

Leo K. Wilson (1925) says: "While it was eating a small snake, a Pygmy Owl was discovered by a Modoc Hairy Woodpecker. Immediately this bird approached the little owl, which ruffled up his feathers much like his cousin, the great horned owl, is wont to do. Apparently this had the desired effect, for the woodpecker promptly flew to another part of the tree." Taylor and Shaw (1927) record interesting news when they say: "J. B. Flett writes of a tragedy that occurred at Longmire during November, when a pigmy owl alighted in a fir tree near his cottage. 'I heard a battle raging outside and went out to find one owl dead and a flock of 8 or 10 camp robbers (*Perisoreus obscurus griseus*), led by a Steller jay (*Cyanocitta stelleri stelleri*), chasing another one into the woods.'" Grinnell and Storer record (1924) that on December 10, 1914—

> a creeper was heard squeaking emphatically, with its attention fixed on the lower branches of a yellow pine. Presently a pigmy owl disclosed its presence by taking flight. * * * Near El Portal, on December 6, 1914, a pigmy owl was obtained through the assistance of solicitous song birds. A bevy of fully fifteen ruby-crowned kinglets was buzzing like bees about the foliage of a tree, each uttering its ratchet-like call, and flitting hither and thither in the most perturbed manner. While the observer was watching, a pair of plain titmouses joined the group, and soon there flew out a pigmy owl, quickly followed by a good part of the excited congregation.

This last experience at El Portal closely parallels several of my own, where I have found a pygmy secluded in dense evergreens, my attention first being attracted through the cries and excitement of flocks of

Steller jays. In these cases the little owls were so well hidden that I would never have found them if I had not investigated the reason for the crying mobs of jays. Several times I have heard of the jays killing the owls just as Taylor and Shaw have recorded.

Dawson, Allan Brooks, Munro, and Taverner all bear witness to the efficiency of the imitation of the pygmy's cry in calling all sorts of small birds about the imitator. P. A. Taverner (1926) gives a particularly interesting story of such a gathering. He says:

> Pause anywhere in its haunts, and whistle an imitation of its call—a half whistle, half spoken '*cook–cook*,' followed by hollow, woodeny, staccato whistles succeeding each other slowly at first, but with a gradually accelerated tempo. and every small bird within hearing will come to investigate. The Nuthatches, hanging head downward, waving their heads like pendulums, and pointing their straight, upturned bills first to one side and then to the other, quanking as they do so. The Chickadees, 'dee-deeing,' their beady eyes twinkling with curiosity. Buzzing, squeaking, excited Hummingbirds will hum angrily around. Sparrows, Wrens, Vireos, Warblers, Jays, and many others, hurry with anxious cheeps to the spot, from the deep tangles of the brush, the middle thicket of the branches overhead, or even the topmost tip of the giant yellow pines, and press in excited review about the alarum. * * * If another Pygmy Owl hears the call, it comes immediately to challenge the intruder, sometimes two come together, find in each other the opponent they were seeking, and join in furious if elf-like combat.

In addition to the mobs of jays, pygmies have other killing enemies to fear. Mr. Michael's notes tell of one that attacked a weasel, apparently more through the love of a fight than otherwise. Unfortunately for the daring little pygmy, the weasel managed to turn and eventually got a deadly hold, so that the owl was killed during the death struggle. I have noticed that the pygmies and the Douglas squirrels seem to be habitual enemies. I do not know that I have ever seen the owl catch or kill one of these squirrels (comparable to the red squirrels of our eastern States), but I have seen many attempts to do so. And I have sometimes found a Douglas squirrel violently "sassing" the owl when the owl seemed to be merely attending to its own business. Laurence M. Huey called my attention to the fact that both Mr. Richardson (1906) and Mr. Daggett (1913) recorded spotted owls, taken in the mountains near Los Angeles, that had each eaten a pygmy owl as examination of their stomachs showed.

Winter.—While the California subspecies generally spends the winter in the same habitat as in summer, severe winter conditions may affect the abundance of the owls' prey and thereby cause the owls to seek temporarily a lower elevation where food might be more abundant. Mr. Michael tells of at least one pygmy owl that lived near the barns of Yosemite in winter for the sake of the mice. In winter the pygmies roost at night in old woodpecker holes, at least in the Yosemite Valley. Mr. and Mrs. Michael say that on "April 22, 1929, there came a cold gray morning with intermittent snow flurries during the afternoon. In spite of the weather we went over to the owl tree to see if the pygmies were at home. We were lucky. One of the owls was in plain sight among the leafless twigs. He was all hunched up, and with his feathers puffed he looked almost as broad as he was long. The morning of February second was grayed by a high cloud cap that covered the sky. On the ground lay the light fall of snow of two days previous. The scramble of blackberry vines opposite the village school had rid itself of most of the snow and here was staged for us a little drama. We were attracted thither, while on our morning walk, by an excited chorus of Sierra juncos. About 50 juncos perched around on the thorny cover, and as a bird uttered a crisp note, which was repeated by his fellows and swelled into staccato chorus, he flecked his tail casting a gleam of white. Suddenly our eyes picked out among the vines upon the ground the desperado that the birds reviled: a pygmy owl squatted over a dark object held in his talons. At this moment the dark object moved and the owl struck it a fierce blow with his bill, and at the owl's movement the chorus of clicks doubled in volume. This seemed to annoy the owl, and grasping his victim firmly in his talons he flitted up onto a thorny blackberry branch 3 feet above the ground. Turning his head this way and that the owl seemed annoyed and confused. He faced us and his deep set eyes glowed black and wrathful." Although the juncos gathered about and abused him, the little owl fed first on the brains and later on the flesh. The juncos stayed for 10 or 15 minutes and then gradually left, leaving the pygmy to finish his meal.

GLAUCIDIUM GNOMA SWARTHI Grinnell

VANCOUVER PYGMY OWL

HABITS

Contributed by Milton Philo Skinner

This race of pygmy owls inhabits Vancouver Island and the adjoining parts of the mainland of British Columbia. Elsewhere the pygmy owls of British Columbia are the coast pygmy owls in the humid coast forests, and the California pygmy owls farther inland where the climate is drier and more severe. The Vancouver form is described by Dr. J. Grinnell (1913) as darker colored throughout than the California form, inclining to bister on the back and with white markings reduced. It is smaller than the Rocky Mountain form and very much darker and browner. In habits the Vancouver bird resembles the coast race.

Courtship.—John K. Lord had the good fortune to see a pair of these pygmies courting and his description (1866) differs somewhat from the observations already given for the California pygmy owl. He says: "In the evening twilight the owls again come out of their hole and take erratic flights around their abode, chasing each other up and down the plain, and performing all kinds of inexplicable manoeuvres. Occasionally they settle on the ground, but never long at a time."

Nesting.—Like the California race, the Vancouver pygmy owl makes its nest in a tree hole, preferably in an oak in an opening, or at least at the edge, of the forest.

Eggs.—The eggs are described by Mr. Lord (1866) as follows: "Early in May two small eggs were laid, white in color, round and very rough on their surface, a large knot-hole in the branch of the tree having been selected as the nesting-place. Nothing of any kind was used as a lining, the eggs being deposited on the bare wood."

Food.—So far as noted, food is largely insects, chiefly grasshoppers, crickets, large beetles, and occasional butterflies. When captured, the prey is held down with one foot while the beak tears at the softer parts. Mr. Lord (1866), "never observed them to capture an insect while on the wing, and a very small quantity of food seemed to supply their wants." H. S. Swarth (1912) speaks of securing only two specimens on Vancouver Island. The first bird was secured about ten o'clock in the morning, when its stomach contained only a few feathers. "The second was taken September 22. * * * This was in the middle of the day and the bird's stomach contained a large dragon fly, evidently just swallowed, sufficient evidence of diurnal hunting."

Behavior.—This pygmy owl is a common resident throughout its habitat, both on the lowlands and in the mountains. That it is abundant on Vancouver Island can be readily inferred from J. A. Munro's note (1919) that he called up four at one time. But in spite of this, the Vancouver pygmy seems to be more timid and of more solitary habits than the other races. Mr. Lord (1866) says that they spent their time "hiding among the thick foliage of the oak or pine, except when feeding. In the first morning twilight the owls were up and in motion, hungry after a whole night's fasting. As soon as their hunger is satiated they return to the tree (an oak-tree), cuddling close together, and doze away the greater part of the day. In the evening twilight the Owls again come out of their hole. As soon as it became dark they retired to their nest, and there apparently passed the night." Mr. Lord's notes indicate that this form is more addicted to the twilight than are the other races. Still, other ornithologists have noted its activity during the daytime.

The flight of this Vancouver pygmy has been described as similar to that of a sparrow hawk. Evidently, then, its flight is much like that of the California bird. According to Mr. Lord, the flight seen by him was somewhat irregular and erratic, but this eccentricity might have been due to the influence of the courting season.

Voice.—Its notes are very much like those of the California form in most respects. Major Brooks (1917) says that: "The rolling whistle of this owl is the greatest of all aids to the collector in the west. An imitation of this, or the single call note, brings every small bird right up to you, even from the tops of the gigantic firs. It also brings up any Pygmy Owl that may be in the vicinity, and I once had one of these come down and carry off an Olive-sided Flycatcher that I had brought down from the treetops and shot." H. S. Swarth (1912) observes that near Errington, in September, "that it was not heard calling until September would seem to indicate that the call note is not given very frequently during the summer months. The notes were heard most often about dark, but also quite frequently during the day."

Enemies.—H. S. Swarth (1912) writes: "I was clambering over a mass of windfall by the edge of a lake in the woods when the agitation of some chickadees at the other end of the tangle attracted my attention. At first there was nothing to be seen, but finally a pigmy owl flew out and lit on a nearby limb."

GLAUCIDIUM GNOMA GRINNELLI Ridgway

COAST PYGMY OWL

HABITS

Contributed by Milton Philo Skinner

This form inhabits the humid coast district of California (north of Monterey County), Oregon, Washington, British Columbia (except Vancouver Island), and southeastern Alaska. It is described as browner than the California pygmy, varying from deep snuff brown to verona brown. Although its habits are much like the races already described, any subspecies that lives in the heavy redwood, cedar, and fir forests of the Pacific coast is almost sure to have striking characteristics of its own. Where these giant trees occur, this little fellow is so fond of them that it actually prefers to remain in the high foliage and seldom comes down to the ground. This is particularly interesting because the other forms notably prefer the lower foliage of trees and bushes.

Nesting.—H. W. Carriger (1895) describes four nests from northwestern California, somewhat east of the heavy coast forests. All were in white oak trees—three in the main trunks, 14 to 20 feet above ground, while the fourth was in a branch 25 feet above ground. Though Mr. Carriger does not say so, it seems likely that these were old woodpecker holes, 2 to 3 inches in diameter. Upon examination the cavities were all found to be about 6 inches inside diameter, but varied from 5 to 18 inches in depth. No nesting material was found in any of the cavities, but the bottom of the deepest "was well filled with bones and pieces of beetles' wings, which goes to show that it had probably been used in previous years" as well. The adult birds were remarkably fearless. Of one case Mr. Carriger (1895) says: "While the nest was being chopped open both birds were very noisy, and often approached within a few feet. The nest contained five eggs in which incubation was highly advanced. While taking the eggs from the cavity the female tried repeatedly to enter." Perhaps this extreme boldness was due to the "highly advanced" stage of incubation. A. Calderwood, Jr. (1889) found a nest in a stub, in what looked like an old nesting site of woodpeckers, five feet above the ground.

Apparently the nesting habits of this subspecies, so far as we know, are similar to those of the California pygmy owl. While the nests cited above were all comparatively low, and in oaks, it is possible that nests may be placed higher where different species of trees are available.

Eggs.—The average number (five) of eggs, in the six sets known to me, is somewhat larger than with other kinds of pygmy owls. The number in each set varies from three to six. Possibly the examination of a larger and more representative series would reduce the average given above. The date of fresh eggs in northwestern California varies from April 26 to May 10, averaging about May 5. J. C. Braly writes me in a letter dated September 20, 1933, that the eggs of the coast subspecies are larger and less round than those of the California pygmy owl. They average about 30 by 24 millimeters.

Plumages.—Little is definitely known of the plumage changes. It is presumed that these follow the same general plan as with the Rocky Mountain and California subspecies. There is at least a fall molt. Chester C. Lamb shot a male in Humboldt County, Calif., on September 28, 1921, that was partially molted, with but few pinfeathers then on its throat.

Food.—The food of this subspecies is much like that of the California pygmy owl. James Moffitt writes me that a female killed by him on February 27, 1922, had the remains of four crickets in her stomach. H. W. Carriger (1895) notes that this subspecies "is active in pursuit of its prey in the early morning hours. Lizards and the several varieties of beetles seem to be its favorite food. One of the birds was met one morning bearing a lizard in its claws." Thomas D. Burleigh (1929) says that one "was caught after it had killed a Rusty Song Sparrow and was trying, without much success, to carry it away." C. H. Townsend, who was in Humboldt County from November 15 to December 17, 1885, writes (1887) that this bird may be seen "engaged in its search for small birds, upon which it seems to subsist largely, flying close to the ground along the borders of tule marshes. It doubtless kills marshwrens and small sparrows, as such birds were often noticed near the hunting grounds of the owl. One

Pygmy Owl, which I shot, had a freshly killed snowbird (*Junco oregonus*) in its claws."

Behavior.—In most of their ways the individuals of this subspecies that live in semiopen country, in the lower foliage and bushes of the Transition Zone closely resemble the California pygmy owls. But in the great forests of Douglas firs, cedars, and sequoias (redwoods) of the coast forests, and also in the Transition Zone, the coast pygmy owls change some of their habits in at least a few ways. James Moffitt, who has a camp 6 miles southwest of Boonville, Mendocino County, Calif., has generously given us many valued notes of his observations. He says: "Redwood is the predominate tree of the numerous creek bottoms and north-facing hillsides. Douglas fir also grows here but attains its greatest development on the summits. Tan-bark oak is a common associate of both. The altitude at my camp is about 900 feet above sea level, and the steep hills rising to each side of the creek are probably 600 to 700 feet higher. Since calling is doubtless a good indication of activity in this species, I judge that the birds are not nocturnal in habit, but are crepuscular at all seasons and partly diurnal throughout the year, increasing activity by day in spring. I have often called these little owls into trees over my head by mimicking their note, to find invariably that they occupied elevated situations in the redwoods a hundred feet or more above the ground. Repeated calling to which the bird usually answered and a change of my location resulted in the owl following me, but always remaining high in the trees. They seem loath to forsake the protection of the heavily foliaged upper zones of the redwoods, and in no case was I able to call a pygmy owl down from the upper regions of these trees. I believe that the pygmy owls of Mendocino County are permanently resident to a rather limited area, because year after year, and at any season of the year, their calls are heard from almost the same situations. I am in the habit of taking early-morning rides and walks from my camp, particularly in the deer-hunting season in August and September, and I usually start such trips at dawn. I have thus learned the favorite localities of at least four pairs of pygmy owls, and it is indeed seldom that one or both of these birds' calls are unheard when these places are visited on an early morning ride. The favored resorts of these four pairs of birds are in the vicinity of my camp, but each is at least a quarter of a mile from its closest neighbor. I have never heard pygmy owls calling in the intervening territory, and this would indicate that the birds have a very limited range. The owls that frequented my camp seemed to range in the trees immediately bordering the creek for a distance of about 400 yards along the watercourse, but apparently they seldom, or never, extended their range far from the sides of the creek, as their calls were never heard in the hillside trees bordering the stream at a distance farther than 100 yards from it. Another pair ranges on the summit of one of the higher peaks of the vicinity, rising directly from my camp, and not more than half a mile distant. Here they appear to be restricted to the heavy Douglas-fir growth of a limited area on the summit. Still another pair is established halfway up a north-facing hillside south of camp, where they appear to be localized within narrow limits. I have never heard pygmy owls in the live, blue, and Kellogg oak woods of the south-lying hillsides that present Upper Sonoran associations. Apparently this owl is strictly a Transition Zone species in Mendocino County." It should be noted that these Mendocino birds prefer the upper foliage and that they seem to be wild and wary.

The flight is like that of the Rocky Mountain and California pygmy owls already described, but it has been observed that in flying at least one coast pygmy owl kept its tail widely spread.

Joseph Mailliard (1922) says of the bathing of the coast pygmy owl: "On September 28, 1921, while camping at the easterly end of Kneeland Prairie, Humboldt County, California, in company with Mr. Chester C. Lamb, the latter came in from a tramp in the woods with the report that he had seen a Coast Pygmy Owl (*Glaucidium gnoma grinnelli*) taking a bath. He described the bird as standing on the edge of a small cattle trough beside the trail and going through the process of ablution in about the same manner as any other bird. The trough was full to the brim and the little owl was dipping and dabbling in the water, finally shaking itself and preening its feathers."

Voice.—The notes of this subspecies are much like those of the California pygmy owl, having the same whistling, trilling, ventriloquial tones. James Moffitt says: "The pygmy owls call more frequently in spring than at other seasons of the year, when it is not uncommon to hear their whistling note throughout the morning and early in the evening. At other seasons the calls are mainly uttered from about dawn for two or three hours, after which the birds are quiet until late in the afternoon, when calling again commences about two hours before dark. The birds seem rarely to call at night. So far as observed by me, calls are always uttered by the bird when it is at rest and never when on the wing. I am unable to distinguish any difference in the quality of the call notes of pygmy owls, and since presumably both sexes call, their voices are alike."

Enemies.—Mr. Moffitt tells me that he has never known these owls in Mendocino County to have their whereabouts disclosed by other birds mobbing them, as I have recounted for the other subspecies. But he adds that this may be because these owls range so high in the redwoods that such disturbances would not be noted from the ground. He also adds: "The pair of pygmy owls that frequented the creek by my camp for six years is apparently not in evidence this spring, 1933.

Their former range is now occupied in part by a pair of northern spotted owls (*Strix occidentalis caurina*). It may be that the larger birds drove the pygmy owls to new haunts." But I am a little doubtful of this last observation when I recall the finding of remains of pygmy owls in the stomachs of southern Californian spotted owls as already recorded under the California pygmy owl. And the quotation below, from H. W. Carriger, leads me to wonder if the screech owl, also, preys on the pygmy. I recall that Dr. T. S. Roberts (1932) gives the screech owl an unsavory reputation in this respect. Mr. Carriger (1895) says of one of his nests, known to have been used by pygmy owls that when opened: "a California Screech Owl was found within. It was presumably a male which had selected the Pygmy Owl's nest as a hiding place during the daytime. It had apparently occupied the cavity for some time."

Winter.—Dr. Cooper, as quoted by Dr. Elliott Coues (1874) writes: "On the 1st of November, 1854, I observed it among a flock of Sparrows, which did not seem at all frightened by its presence. For some time I thought it was one of them, though its large head and owl-like flight seemed to me strange. It was plainly diurnal in habits, not seeming to seek any shelter from the sunshine. Its stomach contained only insects, and it is probable that it does not often attack birds." Probably the latter observation is true of the winter season. Because these birds seem to be less often seen in winter than individuals of at least the Rocky Mountain and California subspecies, there is a lack of winter observations, but H. W. Carriger (1895) says: "One rainy day in October two were met sitting side by side in the low limbs of a laurel tree, and they retained their position until the limb was forcibly shaken, and then flew to another portion of the tree." Mr. Carriger's observations were made in Sonoma County, and probably not in a redwood belt as Mr. Moffitt's were.

GLAUCIDIUM GNOMA HOSKINSI Brewster

HOSKINS'S PYGMY OWL

HABITS

This little pygmy owl is found only in the Cape region of Lower California, Mexico, from latitude 27° N. southward. The type was taken by M. Abbott Frazar in the Sierra de la Laguna, on May 10, 1887.

William Brewster (1888) named it, and described it as "similar to *G. gnoma californica* but smaller and grayer, the forehead and facial disc with more white, the upper parts less distinctly spotted." Robert Ridgway (1914) describes it as "very similar in general coloration to *G. g. gnoma*, but streaks on under parts browner (less blackish) and band across throat much paler brown; wing shorter and tail longer."

About all we know of the habits of this owl is contained in the following account by Mr. Brewster (1902):

> This little Owl was discovered by Mr. Frazar on the Sierra de la Laguna, where it frequents the largest pines and oaks on the top and sides of the mountain. It appears to be rather common, for several were heard calling almost every night in May and early June.
>
> "Their notes resemble the syllables *cow, cow, cow,* repeated a number of times." Only three specimens were secured. One of these was followed after dark and shot while in the act of calling; another was started from some thick brush in the daytime; and the third, also shot by daylight, was sitting in a tree surrounded by a noisy and excited mob of little birds, chiefly Baird's Juncos. During Mr. Frazar's autumn visit to the Sierra only one of these Owls was heard, on the night of November 30. Probably they do not call freely at this season. Hoskins's Owl is apparently not confined to the Cape Region, for Mr. Bryant reports that he "shot a male at Comondu, March 22, 1889."

GLAUCIDIUM BRASILIANUM RIDGWAYI Sharpe

FERRUGINOUS PYGMY OWL

HABITS

The northern race of this South American owl ranges north into the Lower Rio Grande Valley in Texas and into southern Arizona. It was first added to our fauna by Major Bendire (1892) who "took several in 1872 in the heavy mesquite thickets bordering Rillitto Creek, near the present site of Camp Lowell, in the vicinity of Tucson, Arizona. The first specimen was taken January 24, 1872, showing that it is a resident throughout the year; other specimens were obtained during the following spring and summer."

Ridgway (1914) describes it as similar to the typical race, *G. b. brasilianum,* of Brazil, "but lighter in color and averaging rather smaller." It has two very distinct color phases and an intermediate phase, which is a combination of the two extremes. He gives full descriptions of the three color patterns, which he designates as a grayish-brown phase with white tail bands, a grayish-brown phase with rufous tail bands, and a rufescent phase.

Nesting.—George B. Sennett (1889) says: "On May 2, 1888, my collector took an adult female and one egg of this Owl at Cañon del Caballeros, near Victoria, Tamaulipas, Mexico. The locality is high and at the base of the more precipitous mountains. The nest was in a hollow tree, and contained but a single fresh egg."

Major Bendire (1892) mentions a set of four eggs received by Mr. Sennett and taken within our boundaries: "The latter were found on May 3, 1890, and were apparently fresh. The nesting site was a Woodpecker's hole in a mesquite tree, about 10 feet from the ground, in thick woods near Brownsville, Texas."

M. French Gilman (1909) found a nest of the ferruginous pygmy owl near the Gila River, Arizona, of which he writes:

> The only complete set found contained four eggs, and was discovered by seeing the bird leave the nest while I was a short distance from the tree and before any alarming demonstration had been made. She was very shy about returning to the nest. After returning, she hesitated some time before venturing into the hole, and when she did enter, she came out at once for a look around. At my first movement she hastily left the nest again, and when she came back her mate accompanied her. This nest was a deserted Gila Woodpecker's hole 20 feet from the ground in a cottonwood tree. While they are sitting on a tree in plain sight they are not shy, but when in a hole they are very timid, afraid of being captured I suppose. A few times I have seen a head stick from a hole but every time the bird got out before I could approach very near.

George F. Breninger (1898) says: "Among the growth of cottonwood that fringes the Gila and Salt rivers of Arizona this Owl is of common occurrence. * * * Its nest is usually an abandoned woodpecker's hole, which is used from year to year. No lining is used, and the three or four white spherical eggs are laid upon the bottom of the cavity, without any material being added either for the comfort of the setting bird or for the fledglings. Nidification in this valley usually takes place about the 20th of April."

Eggs.—The ferruginous pygmy owl lays ordinarily three or four eggs and occasionally five. Bendire (1892) writes: "Compared with eggs of *Glaucidium gnoma californicum*, the shells are apparently much thicker, and are rather coarsely granulated, considering their small size, considerably more so than the egg of *Micropallas whitneyi*, and they are not as glossy as the latter. The texture of the shells is decidedly different from that of the eggs said to be those of the California Pigmy Owl. In none of the specimens before me are the peculiar punctures or pittings noticeable and purporting to be characteristic of the eggs of the preceding species. In fact, the reverse is rather the case, most of the specimens showing a few slight protuberances on their surface."

The eggs are pure white and shaped like the eggs of the other small owls. The measurements of 50 eggs average 28.5 by 23.2 millimeters; the eggs showing the four extremes measure **30.5** by 23.3, 29 by **24.5**, **26.5** by 23, and 29.4 by **21.6** millimeters.

Plumages.—I have been unable to learn anything about the downy young, or the sequence of plumages and molts of this little owl. Ridgway (1914) says that the young are "similar to adults, but pileum without distinct (if any) streaks."

Food.—On the authority of Carl Euler, Major Bendire (1892) says:

> According to this authority, small as the Ferruginous Pigmy Owl is, it has been known to carry off young chickens, and he was informed by the natives that it even attacked Jacú hens (*Penelope*), a bird of greater size than domestic fowls. It was stated to him that the little Owl fastened itself under the wings of the latter, gradually tearing it to pieces, and wearing it out and eventually killing it. I am aware, from personal observations, that some of our small Owls are the peer, as far as courage is concerned, of the noblest Falcon ever hatched, but I should not

quite care to father that story. Carl Euler says, further, that in captivity, when fed on birds, it always carefully removed all the larger feathers from the carcass before beginning its meal.

Mr. Gilman (1909) says of one he had in captivity: "She freely ate the bodies of small birds collected, and was properly patriotic in that she showed a savage delight in assimilating English Sparrows. I kept her about six weeks and her appetite improved all the time, any small fry being grist for her mill. She usually began eating at the head, and while she ate freely in the daytime, she disliked being watcht at her meals."

Behavior.—Mr. Gilman (1909) writes:

> At Agua Caliente I heard one of these owls hooting repeatedly one hot day, and investigating, found two hummingbirds busily attacking him as he sat in a mesquite tree. I began to look for his mate and soon saw a promising looking Gila Woodpecker hole some seven feet up in a palo verde tree. Wishing to capture Mrs. Pygmy if she were at home I softly crept to the tree and stept up on a low branch in order to reach the hole. At the first noise the bird attempted to leave, but a hand clapt over the hole stopt her. A big handkerchief was thrust down the hole while I enlarged it sufficiently to insert my hand and arm. When my hand reached the bottom I thought it was in contact with a live wire, and I was absolutely sure I had "grabbed a live one."
>
> When the hand was withdrawn the owl came along quite easily. One claw was thru the nail of my little finger, another imbedded in big finger, while her beak was thrust deep into my thumb. Blood was running from all three wounds, and the bird hung on like a bulldog. It took no little diplomacy to remove her without forming an entangling alliance with the other hand, but she was finally safe in a handkerchief. I will back one of these owls in a rough and tumble fight with anything twice the size.

Mr. Breninger (1898) says:

> Unlike other members of the Owl family this species feeds largely during the daytime. I have had them pounce down upon and carry away wounded birds as large as robins. * * * They can be seen perched out on some exposed situation surveying the ground beneath, and nothing seems to pass unnoticed. With eyes that never sleep and pluck that never diminishes until death, it is a formidable foe even to the large rodents that burrow in the sands and alluvial deposits of the river bottoms.
>
> Not long since I came upon a single individual seated upon a leafless limb of a cottonwood tree. Being prompted to learn how close an approach the owl would allow without seeking other quarters, I came within a few feet of being directly beneath the bird when a quail flew up near my feet. With a hunter's instinct my gun came to my shoulder and the quail fell some thirty or forty yards off. The shot did not disturb the owl in the least. After securing the game I threw it beneath the owl; its eyes were at once turned groundward, and its gaze upon the lifeless form of the quail was so intent that I succeeded in climbing to within five feet of the bird before its eyes were turned toward me; then, with a few erratic jerks of its tail, it flew to another tree where it soon called up its mate.

Voice.—Major Bendire (1892) says: "Its call, according to my notes, is 'chu, chu, chu', a number of times repeated, and most frequently heard in the evening. According to Mr. F. Stephens, its note is a loud 'cuck', repeated several times as rapidly as twice each second. He further states that at each utterance the bird jerked its tail and threw back its head. Occasionally a low 'chuck', audible for only a short distance, replaced the usual call."

Again he says that Carl Euler "gives its call note as 'khiu, khiu.' Apparently none of us here mentioned agree on the call note of this Owl, and I leave it to the reader to take his choice."

DISTRIBUTION

Range.—South and Central America and the Southwestern United States; nonmigratory.

The range of the ferruginous pygmy owl extends **north** to Arizona (New River, Tucson, and Fort Lowell); and southern Texas (Lometa and Brownsville). **East** to Texas (Brownsville); Tamaulipas (Matamoros, Rio Cruz, Rio Martinez, Forlon, and Altamira); eastern San Luis Potosi (Valles); Vera Cruz (San Jose Acateno, Presidio, Otatitlan, and Catemaco); Yucatan (Tunkas and Chichen-Itza); Quintana Roo (Cozumel Island and Camp Mengel); southeastern Lesser Antilles (Trinidad); British Guiana (Mount Roraima); eastern Brazil (Cajetuba Island, Maranhao, Ceara, Bahia, Sapitiba, and Rio Tacutu); and Argentina (Parana). **South** to Argentina (Parana, Santiago del Estero, and Rosario de Lerma); and Chile (Valdivia). **West** to Chile (Valdivia); Peru (Arequipa, Pisco, Lima, Cajabamba, and Tumbez); Ecuador (Babahoyo, Vinces, and Yaguache); Panama (Calobre); Costa Rica (Cartago, Alajuelo, and Bolson); Nicaragua (Chontales); Honduras (Segovia River); Guatemala (Naranjo and Duenas); Oaxaca (Huiltepec and Tequisistlan); Guerrero (Acapulco); Michoacan (La Huacana); Nayarit (San Blas); Sinaloa (Esquinapa); Sonora (Caborea and Sonoyta); and Arizona (Sacaton, Phoenix, and New River).

The range above outlined is for the entire species, which has, however, been separated into two geographic races. The typical form (*Glaucidium brasilianum brasilianum*) is South American, while *Glaucidium b. ridgwayi* is found in Central America, Mexico, and the Southwestern United States.

Egg dates.—Texas: 8 records, March 28 to May 28.

Mexico: 6 records, April 22 to May 6.

MICROPALLAS WHITNEYI WHITNEYI (Cooper)

WHITNEY'S ELF OWL

HABITS

Plate 92

The type race of Whitney's elf owl is now restricted to southern Arizona, southwestern New Mexico, Sonora, and a narrow belt along the lower Colorado River in southeastern California.

The type specimen was secured by Dr. J. G. Cooper on April 26, 1861, near Fort Mojave, on the Arizona side of the Colorado River; it has since been taken on the California side of the river. The type remained unique for 11 years until Major Bendire (1892) found it near Tucson, Ariz., of which he says: "On April 20, 1872, while pushing my way through a dense mass of willows in the Rillitto Creek bottom, I saw one of them perched in the thicket and shot it. Although I had made considerable noise, it allowed me to approach quite close and did not seem to be disturbed by my intrusion into its retreat. I took several others subsequently, most of them shortly after sundown, by carefully watching for the point from which they uttered their call notes. When they find themselves observed they sit quite erect and perfectly motionless, and may in such a position be easily mistaken for a part of the limb on which they are perched."

The chief haunts of the elf owl are the low, hot, dry Lower Sonoran plains of the river bottoms and the adjacent tablelands in southern Arizona. Here, at least, is its center of abundance, where it is the commonest owl and one of the commonest birds. These plains are scantily covered with a low growth of mesquite and creosote bushes, mixed with various small cacti and chollas, among which the towering candelabra of the giant cactus, or saguaro (*Cereus giganteus*), stand like picturesque sentinels widely scattered over the hard, stony ground. But these tiny owls are not wholly confined to these plains, for they have been found elsewhere in that vicinity. Berry Campbell (1934) writes: "In the minds of most ornithologists, there is no use in looking for these owls outside of the sahuaro cactus belt. This error had probably delayed their discovery elsewhere. Surely it is a mistake to believe that they are limited, for, as mentioned above, they are the most abundant of the owls in the Peña Blanca area. That they nest here there can be no doubt, for number 2164 is a juvenile still in down. As I was stalking it, the parent came up and fed it." He had already referred to the Peña Blanca area as "characterized chiefly as Upper Sonoran grassland. Only in the favorable localities such as in ravines and the larger canyons and on the north facing slope are brush and trees to be found. However, as the country is quite broken, these situations are common enough to make a fair stand of live oak, walnut, and sycamore possible."

We found the elf owl breeding quite commonly in the broken, higher, country around Sabino Canyon, where we collected six sets of eggs on May 23, 1922. The nests were all in the saguaros, which were growing all over the slopes, as well as in the valleys among mesquites, creosote bushes, various chollas, and palo verdes. At that season the desert colors were at their best; the saguaros were crowned with white blossoms, the palo verdes were great bouquets of yellow flowers, a blaze of brilliant color, the ocotillos were tipped with vermilion, the various chollas blossomed in different colors, the prickly-pears glowed with great yellow blossoms, and along the desert trails two species of rainbow cactus were masses of gorgeous flowers, dark crimson with white centers and magenta with yellow centers.

A. J. van Rossem (1936) found elf owls in the cottonwood groves along the Santa Cruz River, at a point some 14 miles from the nearest giant cactus; he "saw at least a dozen birds within half a mile", on May 14, where they were doubtless breeding; this locality is "nearly 40 miles from the extensive groves" of giant cactus near Tucson, where we found them breeding.

Nesting.—The abundance of the elf owls in the region described above can be appreciated from the fact that we collected 15 sets of their eggs in the parts of three days, May 21, to 23, 1922, that we were able to devote to the saguaro plains, and much of this time was taken up with other things. The nests, with one exception, were all in the giant cacti, in old or abandoned holes made by Gila woodpeckers and Mearns's gilded flickers. Nearly all these giants had one or more of these holes, and many of them were fairly riddled with them. Most of the holes were from 15 to 20 feet up, within easy reach from our 18-foot ladder, but some were lower and some as high as 30 feet. One old veteran giant cactus, from which I took one of my sets, had been visited off and on by my companion, Frank C. Willard, since 1904; during that period he had taken from its numerous holes the eggs of desert sparrow hawk, saguaro screech owl, elf owl, ash-throated flycatcher, Arizona crested flycatcher, Lucy's warbler, Gila woodpecker, Mearns's gilded flicker, and cactus wren; on one day he found both woodpeckers and the elf owl nesting in it at the same time; I think it holds the record for all this popular resort.

The prominent ribs of the giant cactus are armed with rows of long, stiff, sharp spines, so that climbing them is a painful process; but, from a ladder, it is easy to chop out the holes, as the pulp is not much harder than watermelon rind. Woodpeckers find it easy to excavate their holes in this pulp, which largely accounts for the popularity of the saguaros as nesting sites. The sap that exudes from the fresh cuts soon hardens around the entrance hole and around the walls of the cavity, forming a hard, firm nesting box, which lasts for many years, furnishing an ideal home for any of the various species that prefer to nest in these cactuses. I have seen skeletons of these giants lying on the ground, in which all the pulp had disappeared, leaving only the hard ribs intact and the gourd-shaped shells of the nesting holes still retaining their shape.

Two surprises that we encountered illustrate the overcrowded condition and the competition for nesting sites in this populous community. One day, we saw an elf owl looking out of a hole in a giant cactus and took a photograph of it. On climbing up to it, we found a saguaro screech owl sitting on a set of three elf owl's eggs. On another day, as we were entering the mesquite forest, between the saguaro plain and the Santa Cruz River, we saw a Gila woodpecker fly out of a hole, about 15 feet up in a mesquite stub; the bird, which was a male, made such a fuss that we felt sure that his mate must be sitting on a set of eggs in that hole. Mr. Willard climbed up, chopped out the hole, and, much to our surprise, pulled out a female elf owl and three of her eggs. I killed and skinned both of these birds and am sure of the sexes. Whether the owl had eloped with the gay woodpecker, or whether she had driven him from his newly made home, or whether the woodpecker was trying to take possession of the hole for his family, I will leave it to the reader to decide.

Clyde L. Field writes to me: "I have taken eggs of Whitney's elf owl on the east slope of the Santa Catalina Mountains, Ariz., at an elevation of 4,800 feet, and in the Santa Rita Mountains, Ariz., at 6,100 feet. I took a bird from a hole in which she would likely soon have laid. The nests were all in sycamore trees, there being no giant cactus for miles. Mesquites were growing nearby. Once, when I was camping in a dry creek, an elf owl could be heard throughout the night. The sound seemed to come from a sycamore some hundred feet away. In the morning a dead stub was noticed in the tree, in which a Gila woodpecker had nested for several seasons. After much hard work I enlarged the hole and found the owl. It was too early for eggs, also for the woodpecker. Three weeks later I returned. The woodpecker had moved up the creek. An Arizona crested flycatcher had moved into the woodpecker's nest and sat on four eggs. The owl was still at home and also had four eggs. I collected both sets. Ten days later I again looked in on them. The flycatcher had taken the owl's home and had three eggs. The owl was using the flycatcher's old nest but had not laid yet. From watching three elf owls' nests, we found that they lay every other day."

Several other accounts of the nesting habits of the elf owl have been published, but they do not differ materially from the accounts given above. Mr. Gilman (1909) found one nesting in a woodpecker's hole in a cottonwood tree. Although it may show a preference for the giant cactus, it apparently will nest in any other suitable hole in any kind of a tree within its habitat.

Eggs.—Major Bendire (1892) says: "From two to five eggs are laid to a set, but the most common number found is three. Of thirty-eight sets taken by Mr. F. Stephens, who found the first eggs of this species, twenty-four sets contained three each, twelve sets contained four, and two sets five eggs. * * * The eggs of the Elf Owl are pure white in color and oval in shape, the shell is finely granulated, and while some specimens are rather glossy, the majority are only moderately so." The measurements of 50 eggs average 26.8 by 23.2 millimeters; the eggs showing the four extremes measure **29.9** by **25**, **26** by 22.3, and 25.9 by **22** millimeters.

Young.—Major Bendire (1892) says: "One of the parents is always at home after the first egg is laid, and frequently both. The male assists in incubation, which lasts about two weeks." Nothing seems to be known about the care of the young, their development, or their habits, except that they are attended and fed by their parents for some time after they leave the nest.

Plumages.—I have seen only one downy young of the elf owl; it was well covered with pure-white down; they are said to be about as big as a man's thumbnail, when first hatched.

In the juvenal plumage the upper parts generally are "drab", more grayish on the pileum; the pileum is nearly, or quite, immaculate, the back is finely and inconspicuously barred with dusky and "ochraceous-tawny", the under parts are grayish white, heavily mottled, spotted, or finely barred with dusky, and without any, or very little, pale buff or brown; the tawny and white face pattern of the adult is only faintly indicated, and there is no buff on the throat; the wings and tail are as in the adult. This plumage seems to be worn for only a short time, as a more or less complete body molt produces, during June and July, a plumage that is practically adult. The complete, annual molt of adults seems to take place in September and October. Ridgway (1914) recognizes two color phases, the commoner, grayish phase, and a browner phase.

Food.—The food of the tiny elf owl seems to consist almost entirely of various insects and their larvae, such as crickets, grasshoppers, beetles, caterpillars, centipedes, and other small fry. Two that Mr. Gilman (1909) had in captivity "freely ate what few crickets and grasshoppers I could secure for them, but refused to eat small birds." Mr. Campbell (1934) found in the stomachs of two of these owls five large bot fly pupae, one Hemiptera, and one vinegarroon. Apparently this little owl is not so savage and aggressive as the pygmy owls, and it does not often attack birds, though feathers have been found in its stomach.

Behavior.—The elf owl is decidedly nocturnal in its habits, remaining concealed during the daytime in some convenient hole, or, more frequently, in some dense thicket or under cover of thick foliage, where it sits motionless and is not easily discovered. I have been told that it does not live in the holes in the saguaros except in the nesting season, but we know very little about its habits at other seasons. In the evening twilight these owls become very active, and may be seen flying about, or may be easily located by their peculiar notes. They are sometimes seen flying about the campfire, probably chasing the insects that have been attracted by the light. William Brewster (1883) quotes the following from field notes of Frank Stephens:

> I was walking past an elder bush in a thicket when a small bird started out. Thinking it had flown from its nest I stopped and began examining the bush, when

I discovered a Whitney's Owl sitting on a branch with its side towards me and one wing held up, shield fashion, before its face.

I could just see its eyes over the wing, and had it kept them shut I might have overlooked it, as they first attracted my attention. It had drawn itself into the smallest possible compass so that its head formed the widest part of its outline. I moved around a little to get a better chance to shoot, as the brush was very thick, but whichever way I went the wing was always interposed, and when I retreated far enough for a fair shot I could not tell the bird from the surrounding bunches of leaves. At length, losing patience, I fired at random and it fell. Upon going to pick it up I was surprised to find another, which I had not seen before, but which must have been struck by a stray shot.

Mr. Brewster (1883) goes on to say: "Rather curiously both of these specimens proved to be adult males. It is by no means certain, however, that the males are not to a certain extent gregarious during the breeding season, for on another occasion two more were killed from a flock of five which were sitting together in a thick bush."

Voice.—Mr. Brewster (1883) says: "They had several different notes, one of which sounded like the syllable *churp;* while another was a low *tw-jur r r r.* These cries were heard at all times of the night, but oftenest in the early evening and again at daybreak."

Mr. Gilman (1909) says of his captive owls: "During the day they remained very quiet, but at night made a choice assortment of noises, which, as I kept them in my room, were very entertaining, especially about midnight. One note very much resembled that of the Western Bluebird, and another sounded like the squeak concealed in a rubber doll."

Field marks.—This is the smallest of all our owls, far smaller than the screech owls found within its range, and even smaller than the pygmy owls, from which it also differs in having a much shorter tail. It is a short, chunky little bird, with a round head. It is less likely to be seen abroad in the daytime than are the pygmy owls.

DISTRIBUTION

Range.—Southwestern United States and Mexico; nonmigratory.

The range of the diminutive elf owl is **north** to Arizona (Fort Mojave, Big Sandy River, Prescott, Fort Whipple, Oracle, and probably Fort Bowie); southwestern New Mexico (Redrock and Silver City); and southern Texas (Chisos Mountains, Hidalgo, and Brownsville). **East** to Texas (Brownsville); and Puebla (Tehuacan). **South** to Puebla (Tehuacan); and southern Baja California (Mira Flores). **West** to Baja California (Mira Flores, San Bernardo Mountain, Todos Santos, and Comondu); Sonora (Querobabi and Magdalena); southeastern California (Bard and Duncan Flats); and Arizona (Batamote Well, Sacaton, New River, and Fort Mojave).

This species of the elf owl has been separated into three races: Whitney's elf owl (*M. w. whitneyi*), the typical race, occupies the southwestern part of the range, except southern Baja California, being found in southeastern California, Arizona, New Mexico and the Mexican State of Sonora. The Texas elf owl (*M. w. idoneus*) occupies the valley of the lower Rio Grande in Texas, and from there south to Puebla, Guanajuato, and the Valley of Mexico. Sanford's elf owl (*M. w. sanfordi*) is found only in the southern part of Baja California.

Egg dates.—Arizona: 28 records, May 3 to June 9; 14 records, May 22 to 26, indicating the height of the season.

MICROPALLAS WHITNEYI IDONEUS Ridgway

TEXAS ELF OWL

HABITS

The Texas elf owl occupies a range quite remote from that of the Arizona bird, in the lower Rio Grande Valley of Texas and thence southward well into Mexico. Robert Ridgway (1914) describes it as "similar to *M. w. sanfordi* in grayness of upper parts and absence of distinct cinnamoneous blotches on under parts, but under parts with more white and with markings darker."

The type was taken by F. B. Armstrong, while camped 5 miles from Hidalgo, Tex., on April 5, 1889, and apparently it has not been taken north of our boundary since. Mr. Ridgway had only two specimens when he named and described the race. Nothing seems to have been published about its habits.

MICROPALLAS WHITNEYI SANFORDI Ridgway

SANFORD'S ELF OWL

HABITS

In southern Lower California, south of about latitude 23°40′ N., this race is separated by a wide gap from the elf owl of Arizona, and it has been given the above name. Mr. Ridgway (1914) describes it as "similar to *M. w. whitneyi*, but much grayer above and (in the gray phase, at least) with much less of cinnamon-buff on face and little if any rusty brown or cinnamon on under parts; gray phase with ground color of upper parts between mouse gray and hair brown, without distinct, if any, darker vermiculations; brown phase similar in coloration to the grayer phase of *M. w. whitneyi* but slightly darker; wing averaging decidedly shorter, tail averaging longer."

William Brewster (1902) says: "Mr. Belding asserts that he found the Elf Owl 'common, if not abundant' at Miraflores in 1882, and that he also met with it in 'the mountains' in 1883, but it 'appeared to be less common here than in the cactus regions' at lower levels."

I can find nothing in print about the nesting or other habits of this owl, which probably do not differ materially from those of other elf owls.

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1932. A bat-eating sparrow hawk. Condor, vol. 34, p. 43.

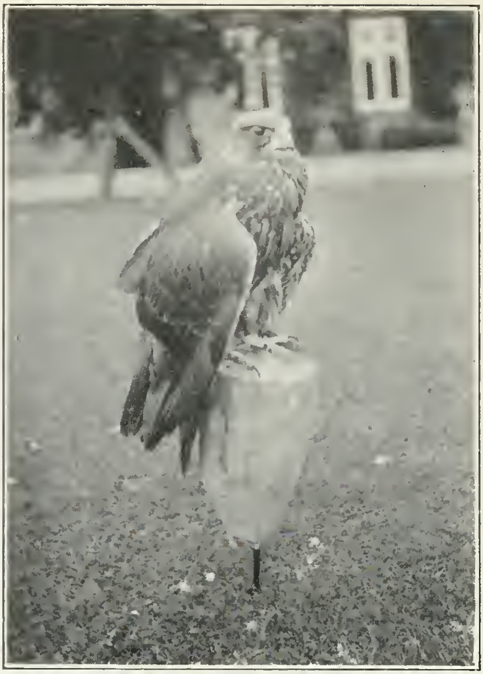
WYMAN, LUTHER EVERET, and BURNELL, ELIZABETH FRAYER.

1925. Field book of birds of the Southwestern United States.

NESTING SITE OF GYRFALCON.

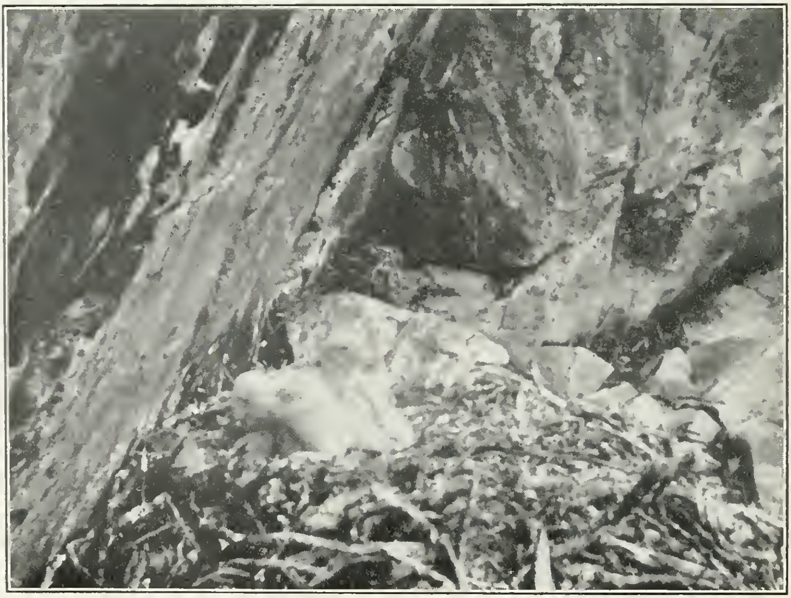
Swedish Lapland, June 2, 1932.

C. T. Dalgety.



July 20, 1932. C. T. Dalgety.

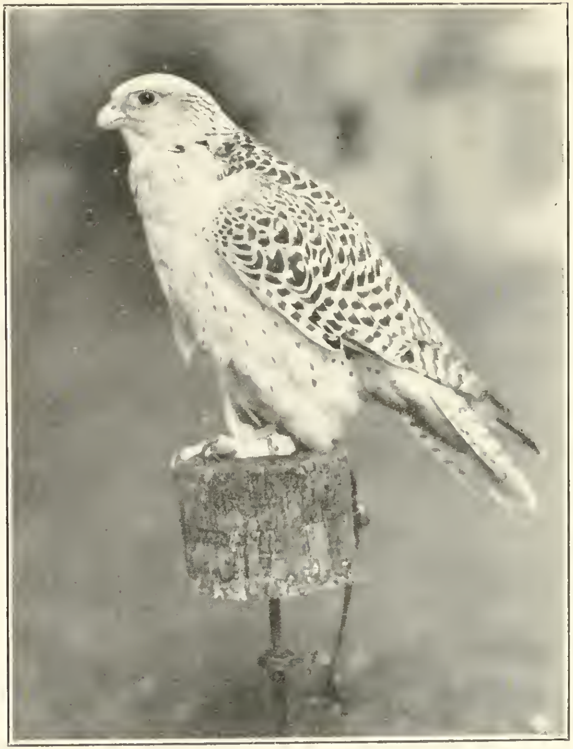
About two months old.



Swedish Lapland, June 2, 1932. C. T. Dalgety.

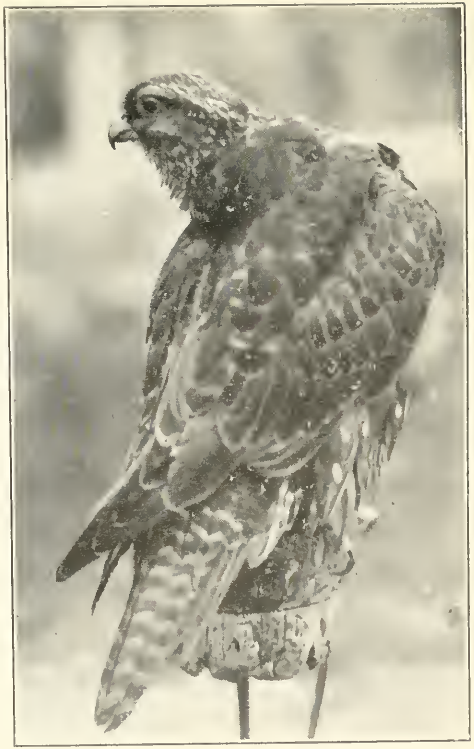
Downy young in nest.

YOUNG GYRFALCONS.



R. L. Meredith.

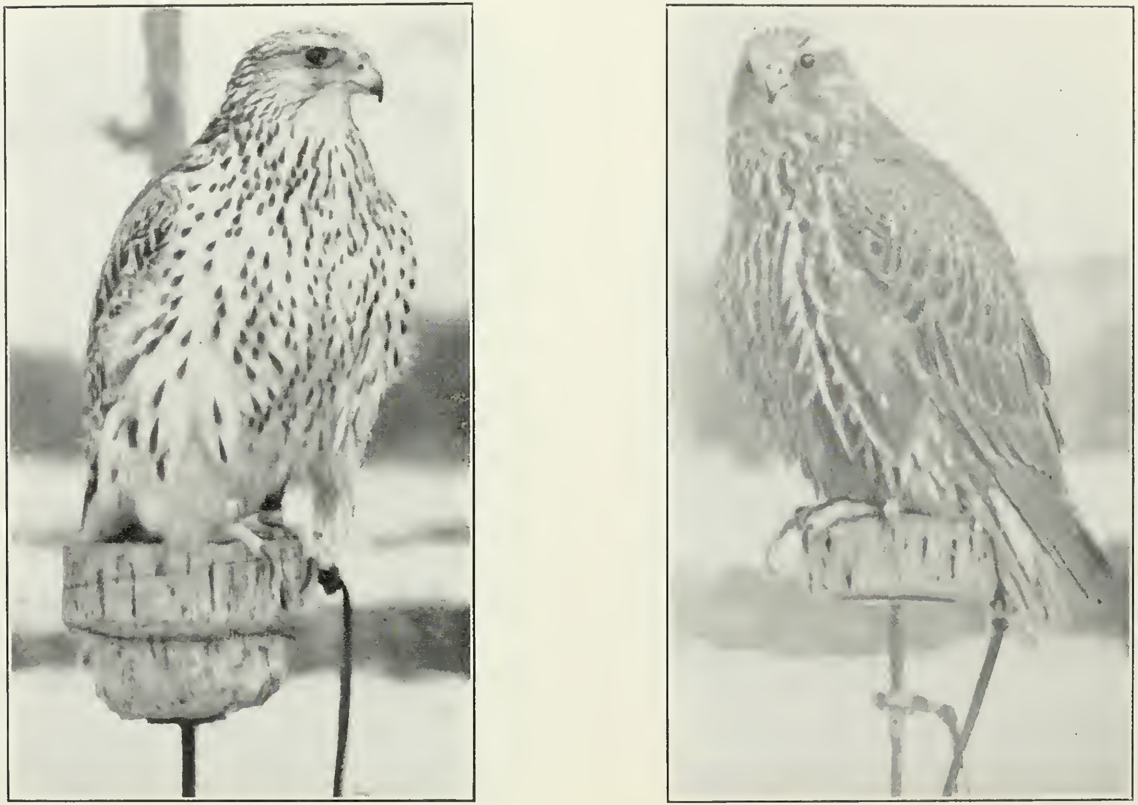
Adult white gyrfalcon.



R. L. Meredith.

Immature black gyrfalcon.

CAPTIVE GYRFALCONS.

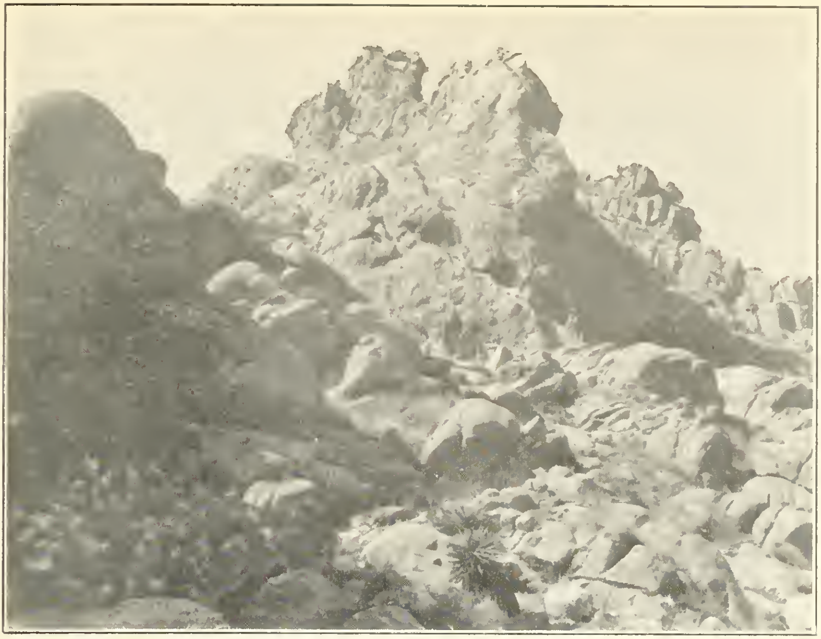


R. L. Meredith.

R. L. Meredith.

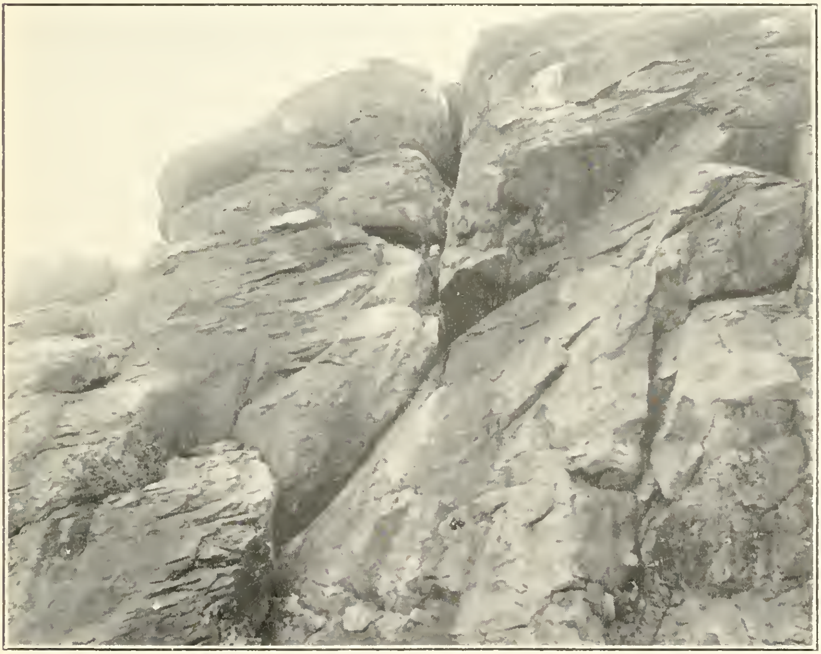
Immature light and dark birds from same brood.

CAPTIVE GYRFALCONS.



Dragoon Mountains, Ariz., April 8, 1922. A. C. Bent.

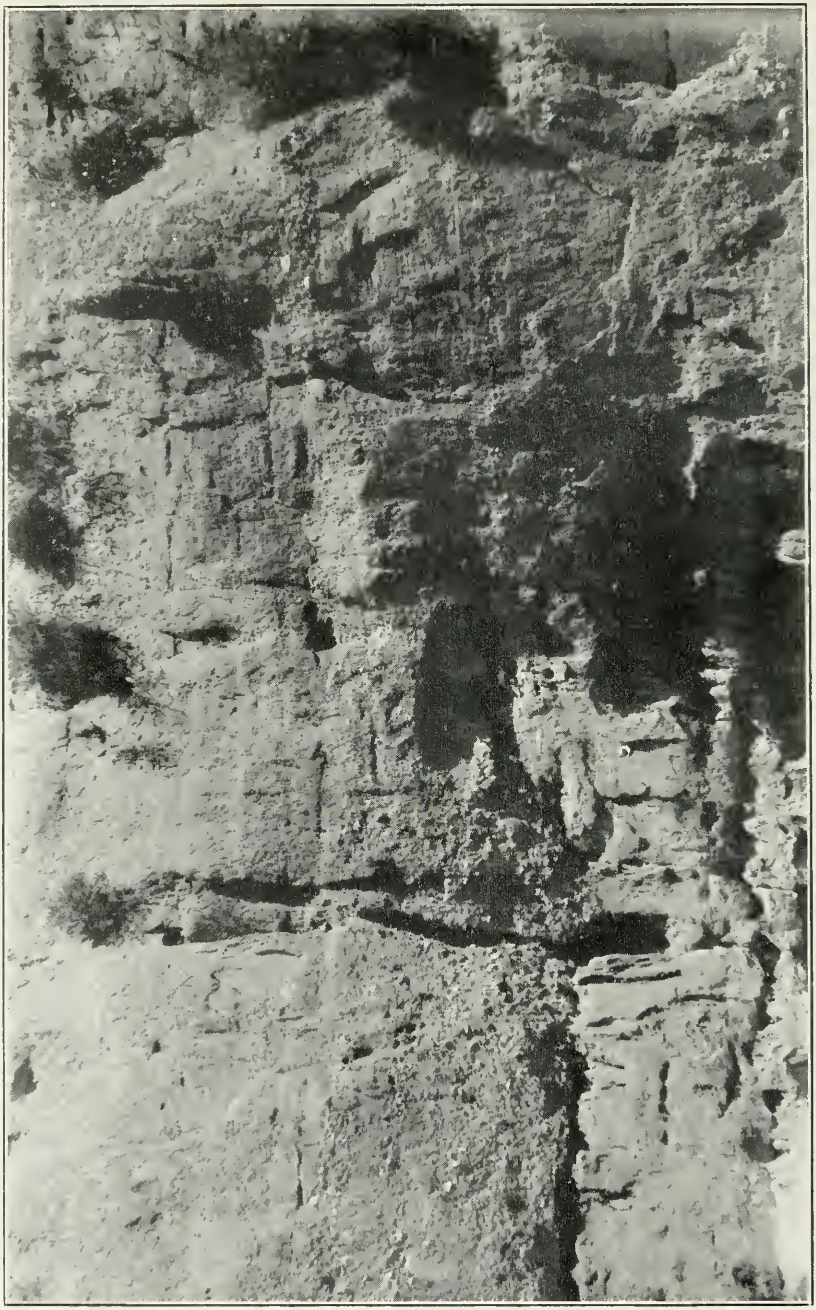
Nesting site in right-hand peak.



Mojave Desert, Calif., April 17, 1929. A. C. Bent.

Nesting site in crevice.

PRAIRIE FALCON.



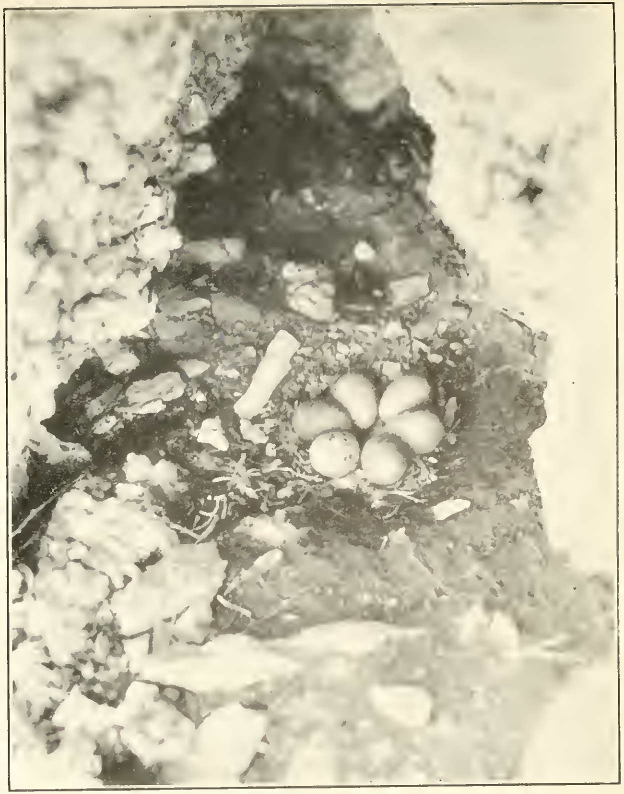
San Luis Obispo County, Calif.

ADULT PRAIRIE FALCON AT NESTING SITE, LOWER CENTER.

W. L. Dawson.

Weld County, Colo., June 6, 1911. E. R. Warren.

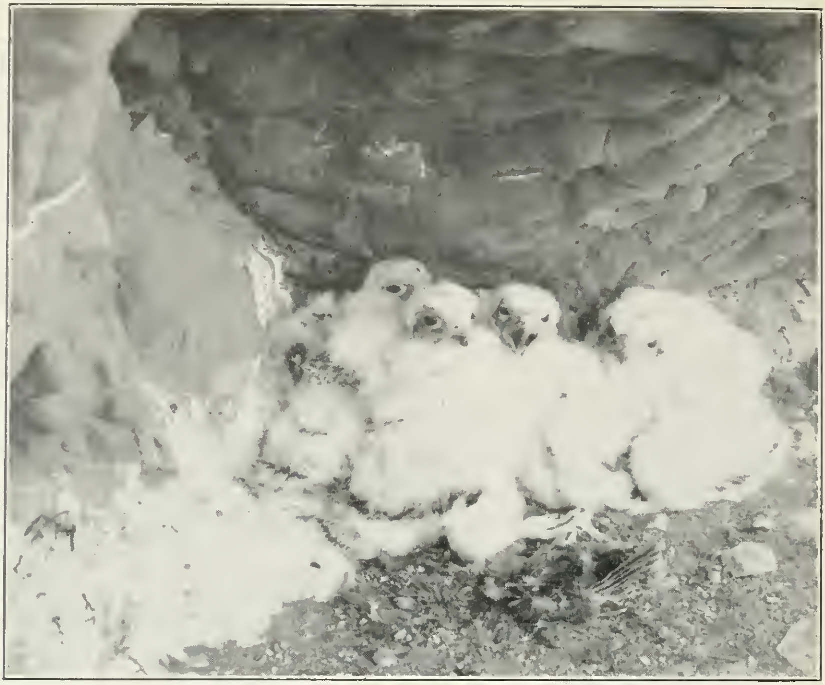
Nesting site.



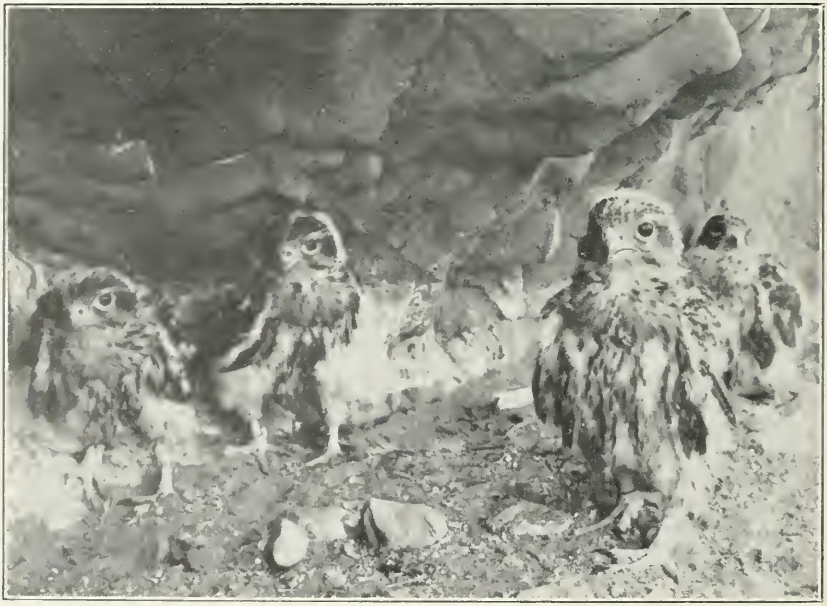
Near Grantsville, Utah, April 10, 1927. L. R. Wolfe.

Large set of eggs.

PRAIRIE FALCONS.



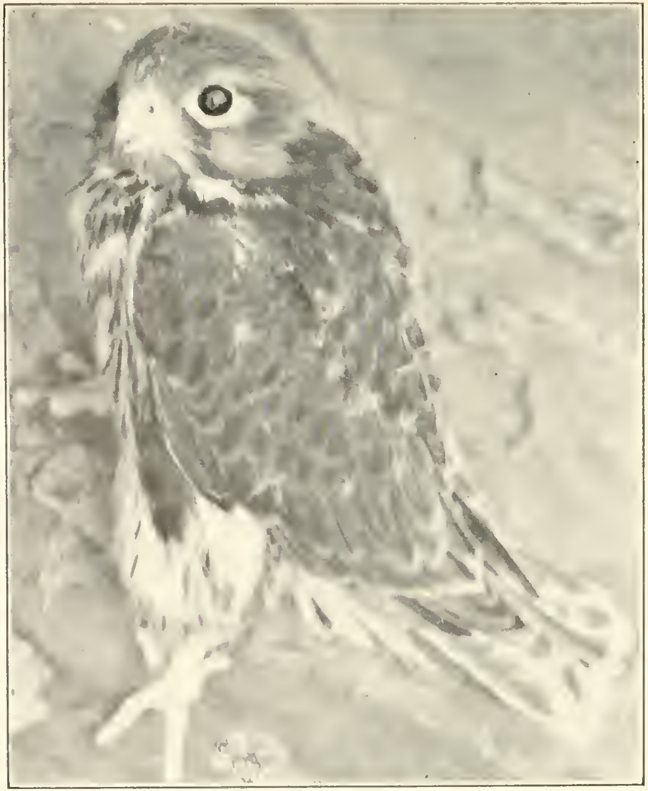
Twenty-three days old.



San Joaquin Valley, Calif. F. H. Fowler.

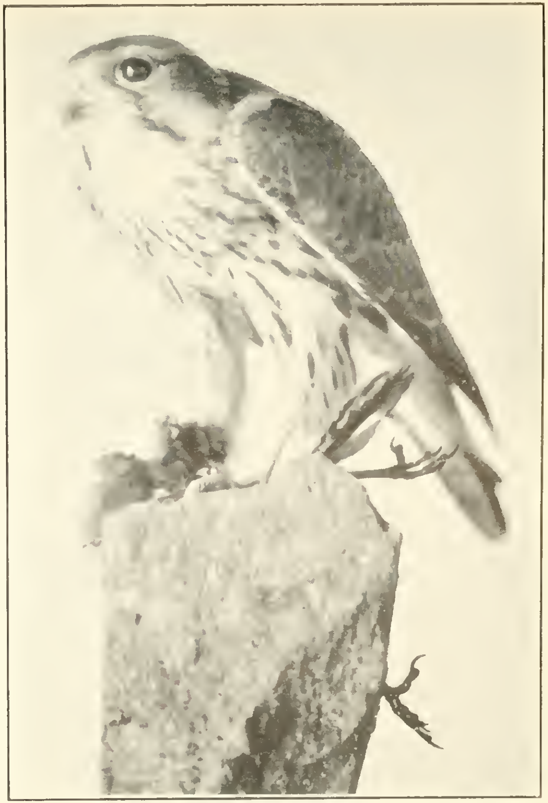
Thirty-three days old.

YOUNG PRAIRIE FALCONS.



San Joaquin Valley, Calif.

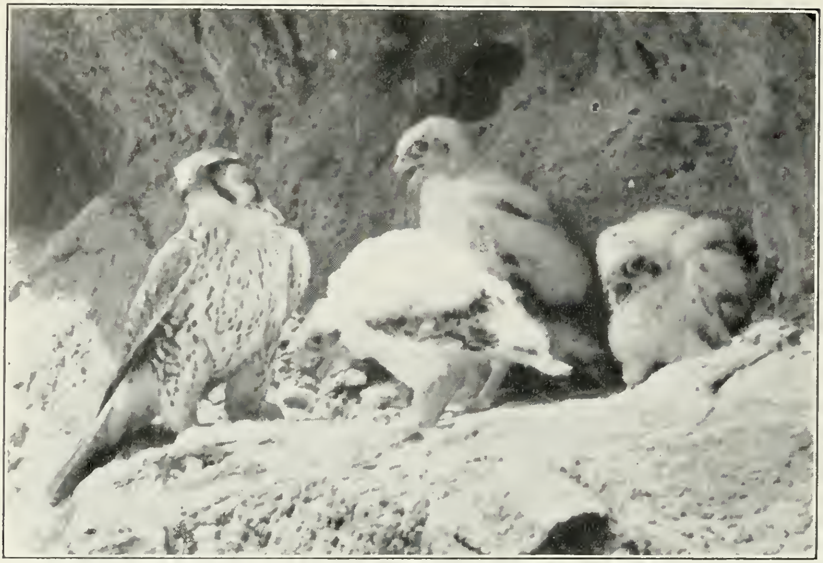
Thirty-seven days old.



F. H. Fowler.

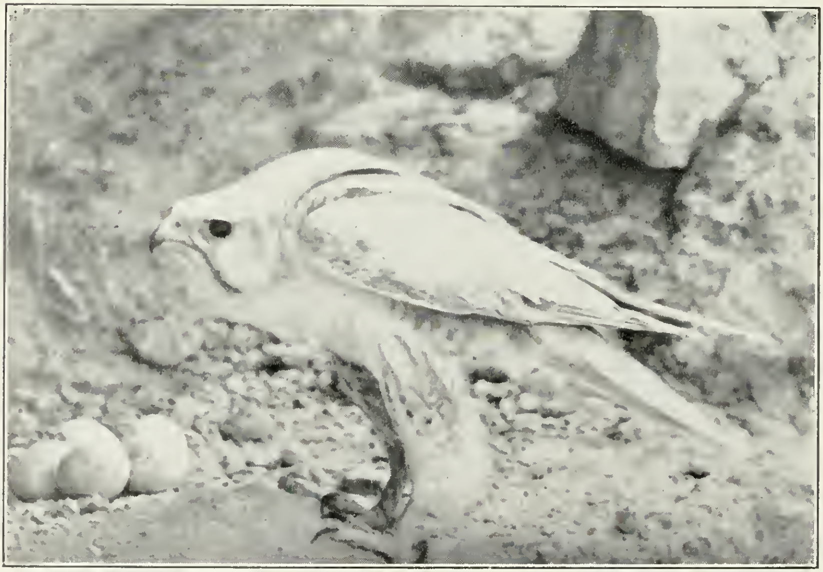
Three months old.

YOUNG PRAIRIE FALCONS.



Adams County, Colo., June 1935.

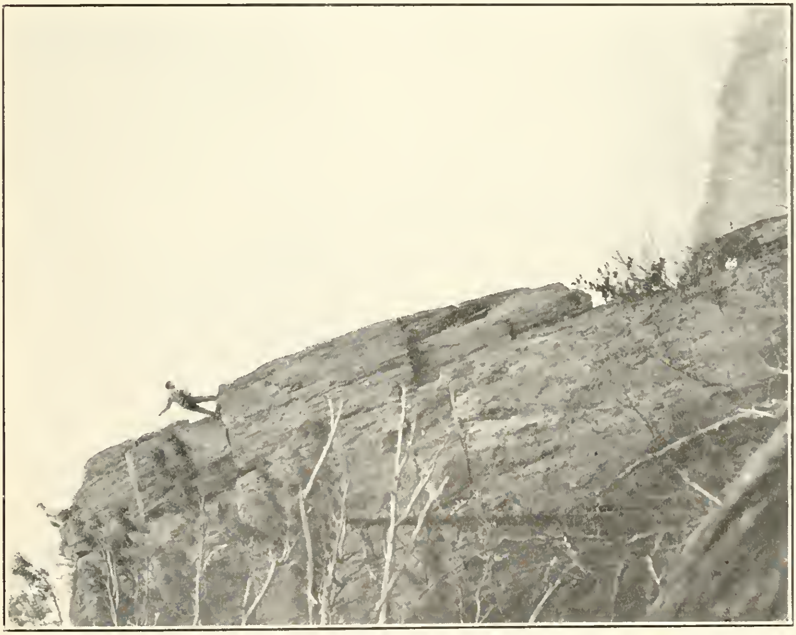
Adult and young.



Weld County, Colo., May 1931 A. M. Bailey and R. J. Niedrach.
Courtesy Chicago Academy of Sciences and Colorado Museum of Natural History.

Albino adult.

PRAIRIE FALCONS.

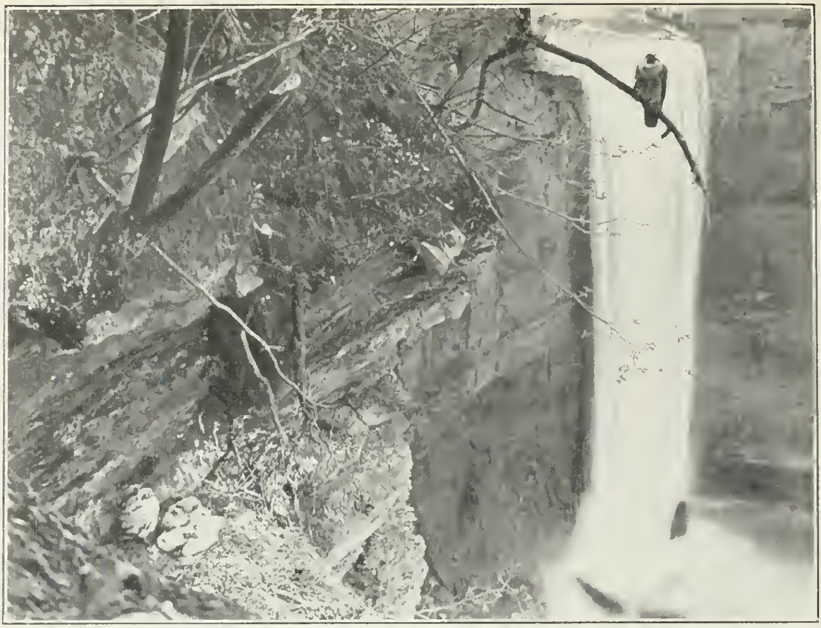


Mount Tom, Mass., April 14, 1928.

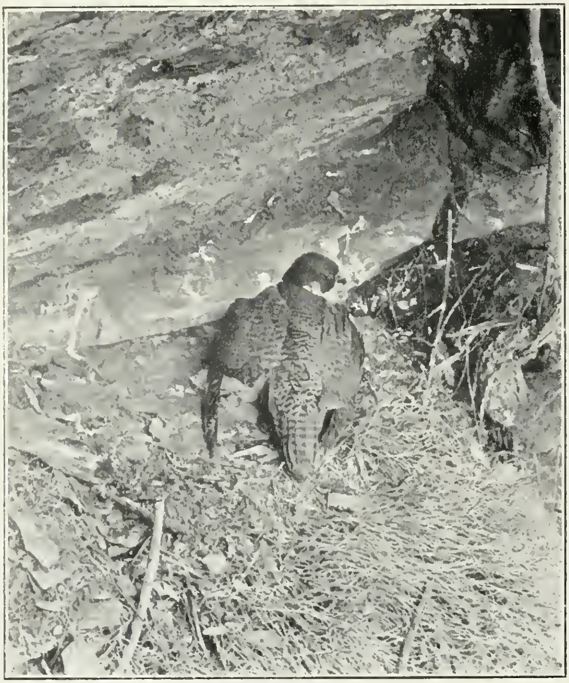
R. L. Coffin.

The historic site and the nest.

NEST OF DUCK HAWK



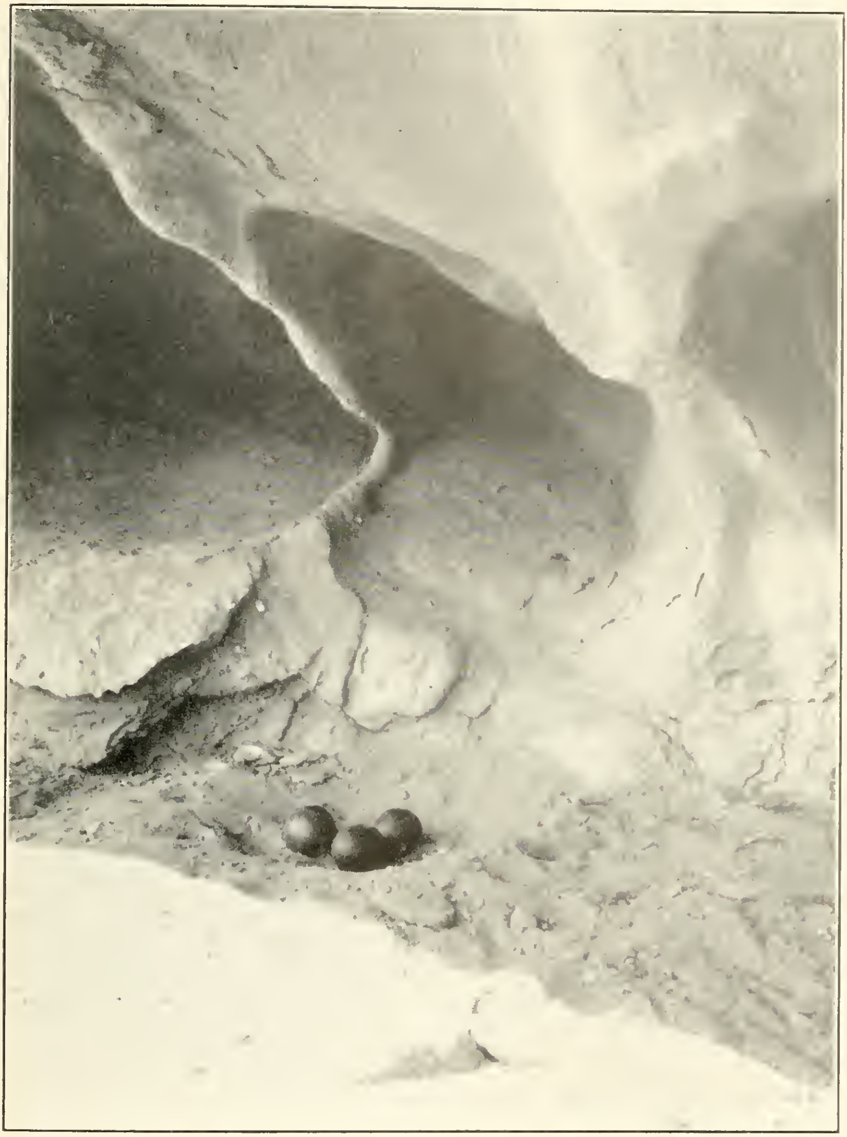
Picturesque nesting site.



Taughannock Falls, N. Y., May 10, 1925. A. A. Allen.

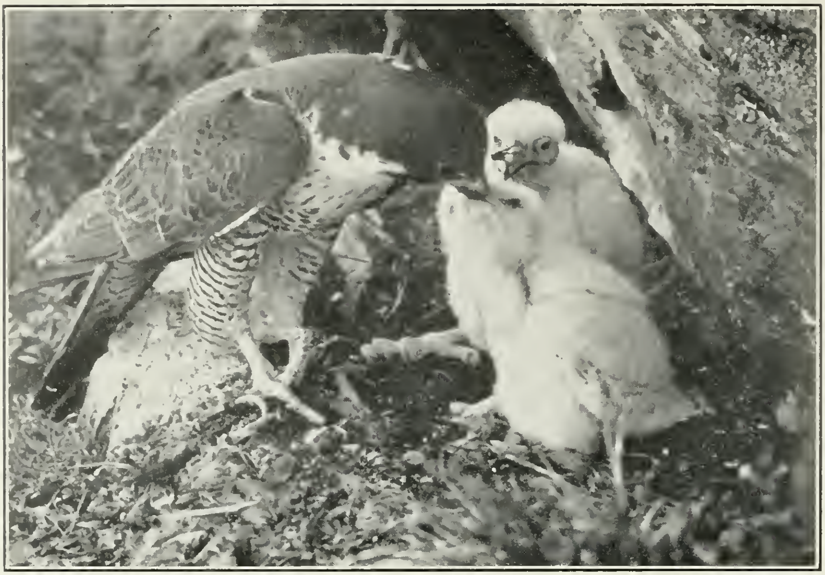
Adult brooding.

DUCK HAWKS.



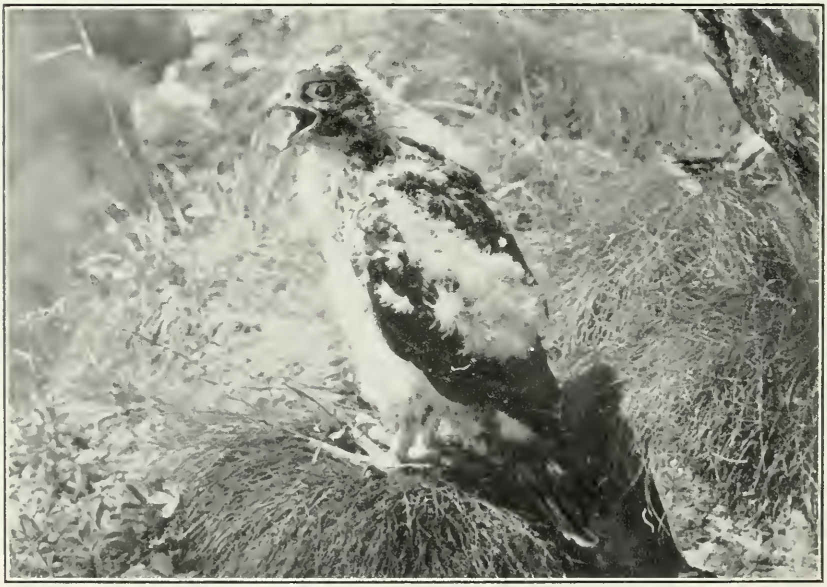
Southern California. W. M. Pierce.

NEST OF DUCK HAWK.



Near Dartmouth, N. H., June 13, 1931. C. A. Proctor.

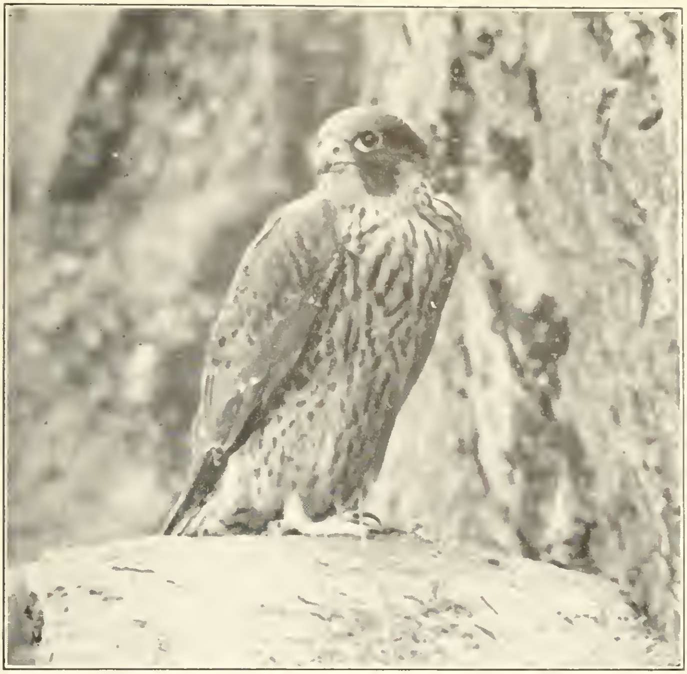
Female feeding young.



Near Dartmouth, N. H., June 29, 1931. C. A. Proctor.

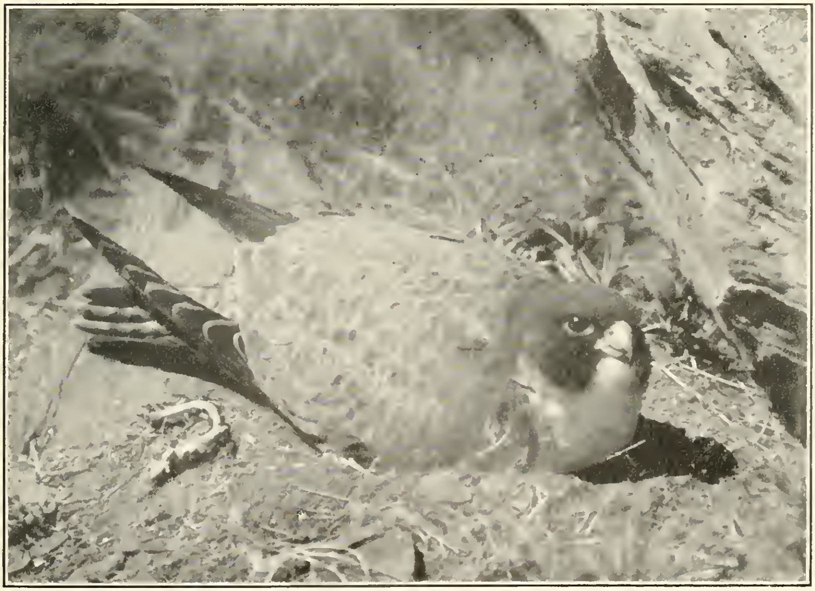
Fledgling.

DUCK HAWKS.



Near Dartmouth, N. H., July 8, 1931. C. A. Proctor.

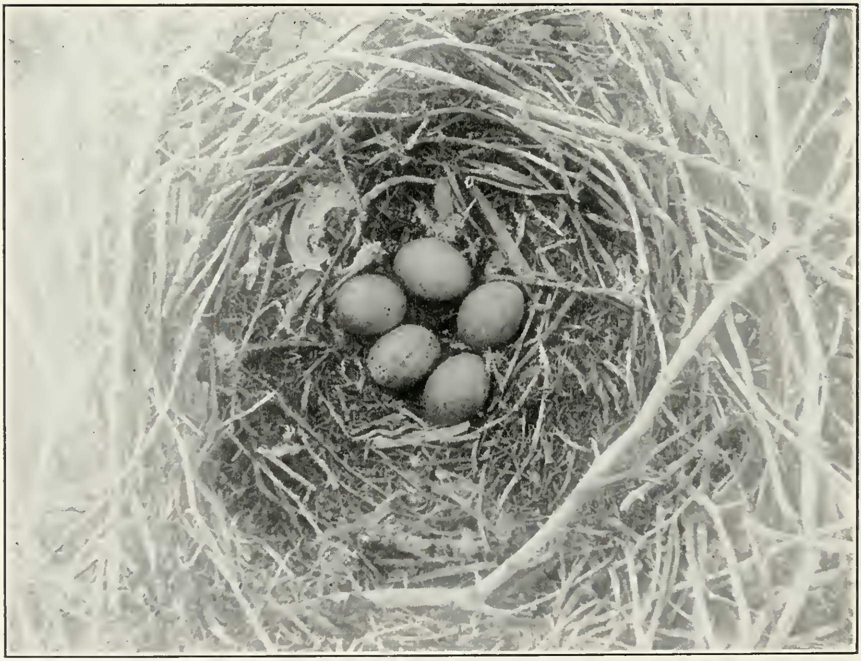
Last young about to leave.



Near Dartmouth, N. H., June 2, 1931. C. A. Proctor.

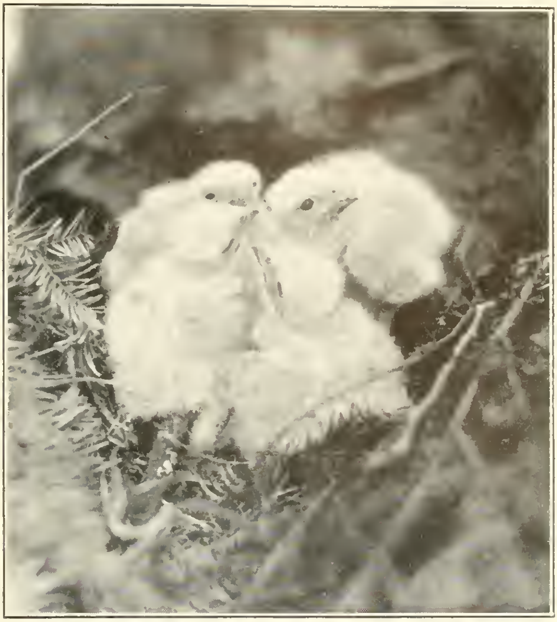
Male brooding.

DUCK HAWKS.



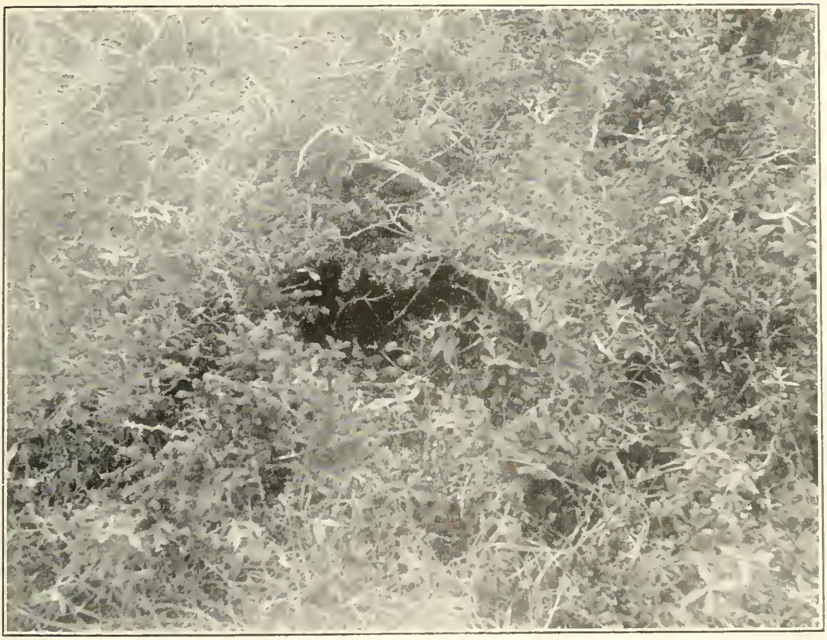
Eskimo Island, Quebec Labrador, June 7, 1909. A. C. Bent.

TWO VIEWS OF NEST OF EASTERN PIGEON HAWK.



Matane County, Quebec, July 2, 1932. W. J. Brown.

Downy young.



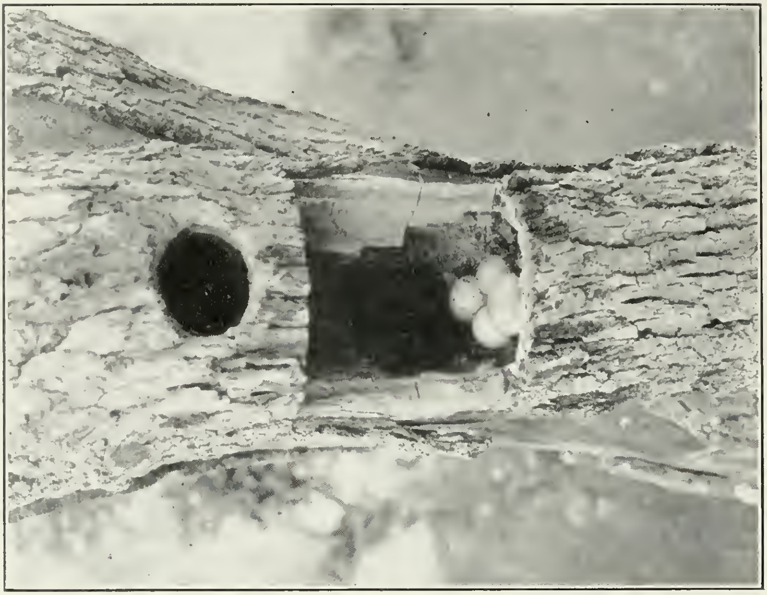
Gafftopsail, Newfoundland, June 19, 1912. A. C. Bent.

Nest on the ground.

EASTERN PIGEON HAWK.

Douglas County, Kans., May 7, 1927. L. V. Compton.

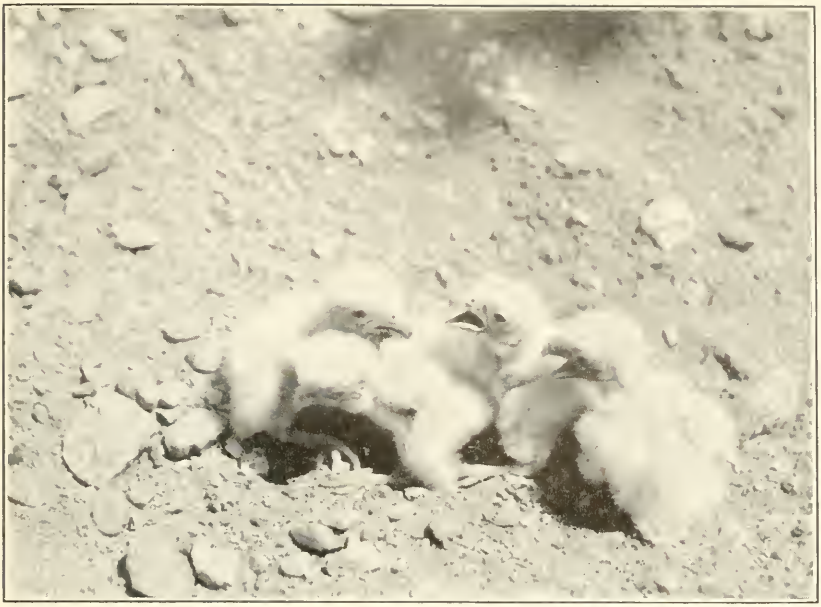
Nesting site.



Bear Creek, Oreg., May 6, 1928. J. E. Patterson.

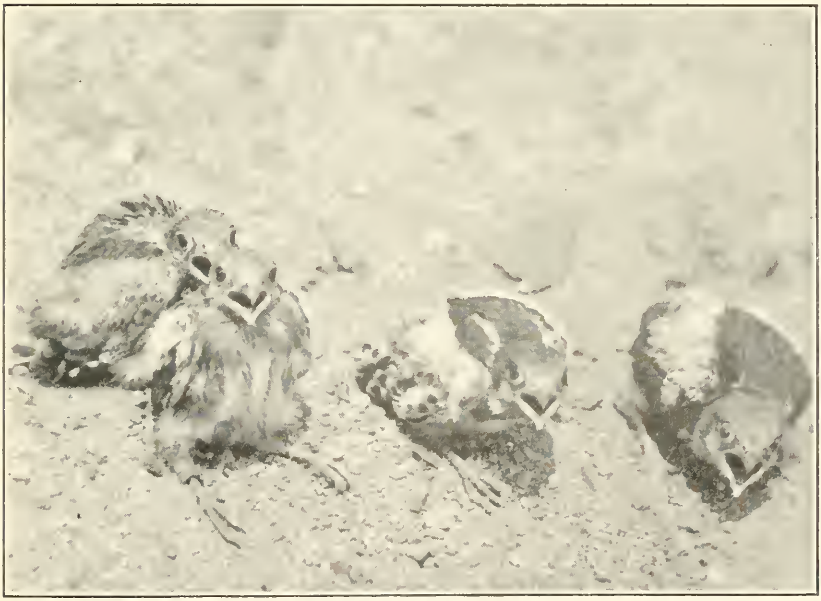
Nest in old flicker's hole.

NESTS OF EASTERN SPARROW HAWK.



Pomona, Calif., May 4, 1928. E. L. Sumner, Jr.

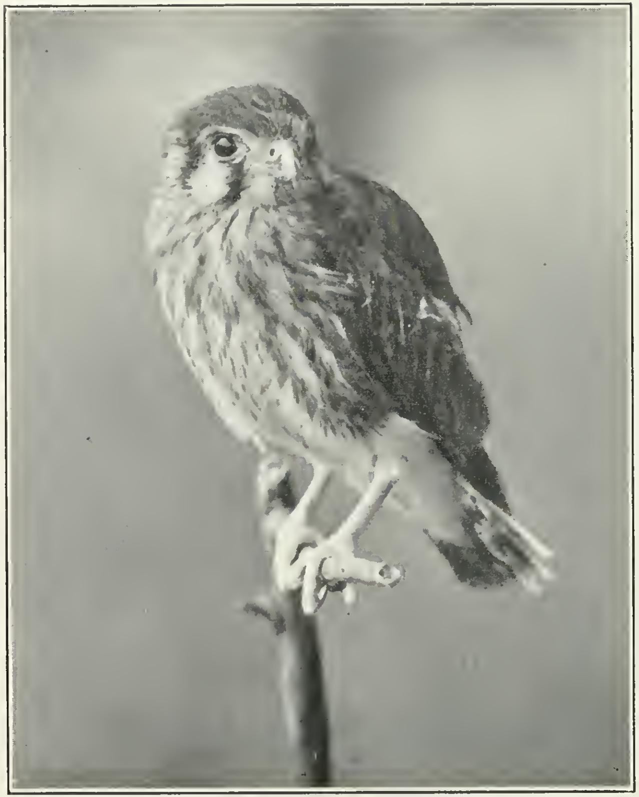
About three days old.



Pomona, Calif., May 19, 1928. E. L. Sumner, Jr.

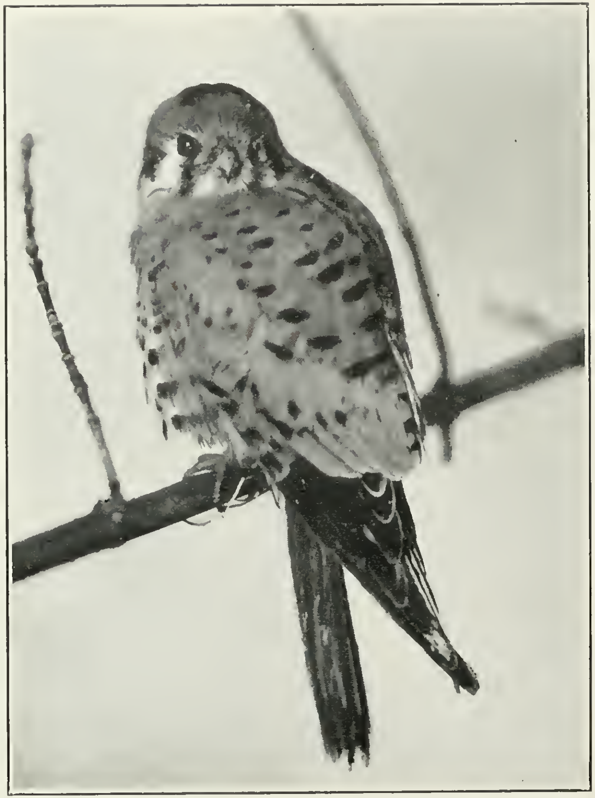
About eighteen days old.

YOUNG EASTERN SPARROW HAWKS.



A. D. DuBois.

Young in juvenal plumage.



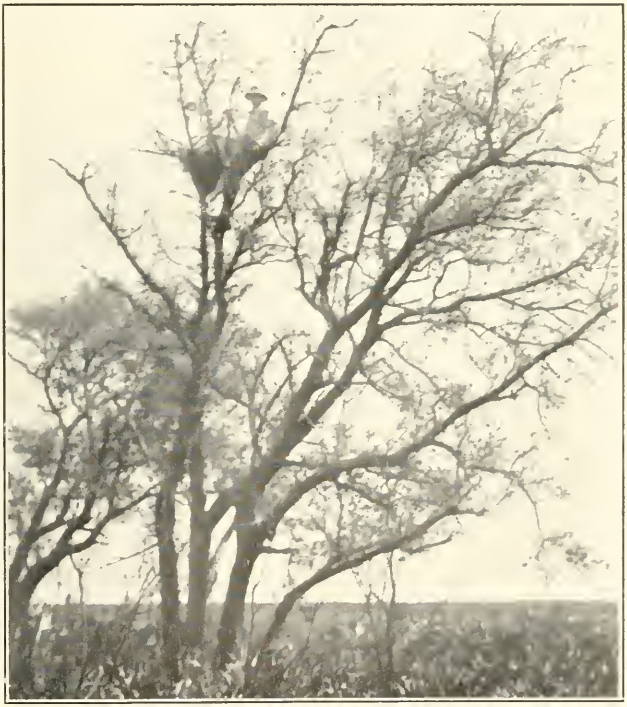
Brownsville, Oreg. L. L. Haskin.

Adult male.

EASTERN SPARROW HAWKS.

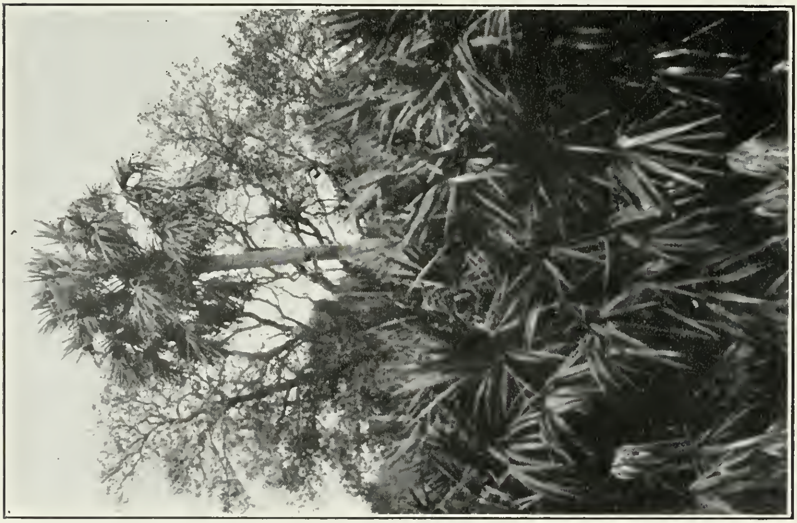
Hernando County, Fla., April 19, 1925. A. C. Bent.

NEST SITE OF LITTLE SPARROW HAWK.

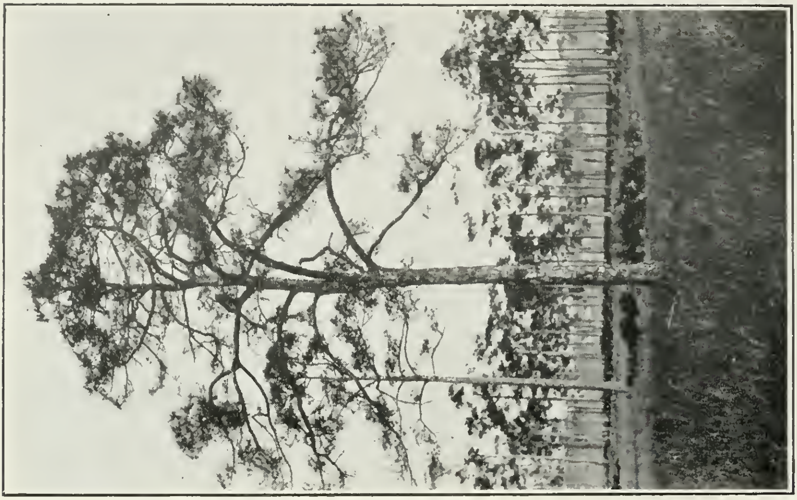


Vero Beach Road, Fla., March 30, 1936. W. A. Smith.

NEST SITE OF AUDUBON'S CARACARA.

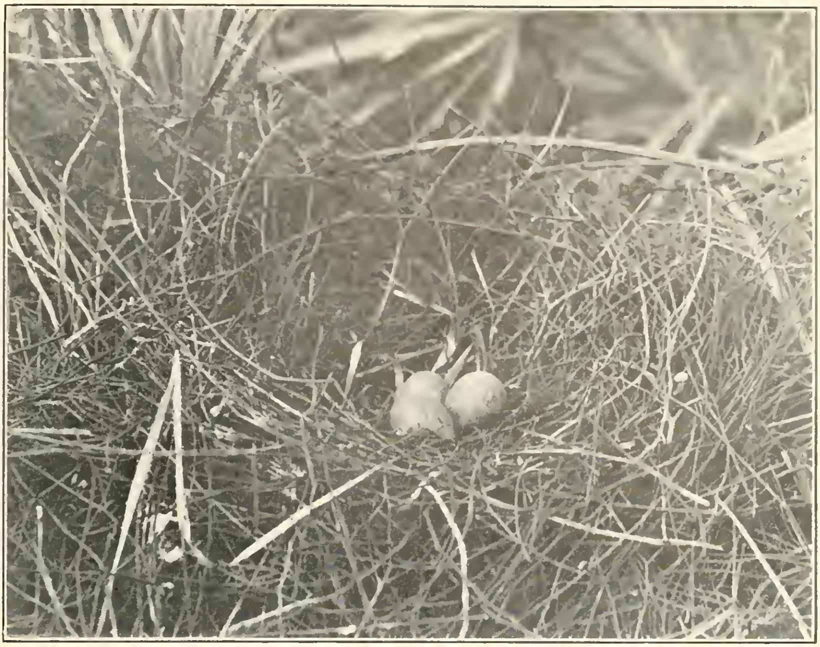


Collier County, Fla., February 15, 1914. F. H. Kennard.



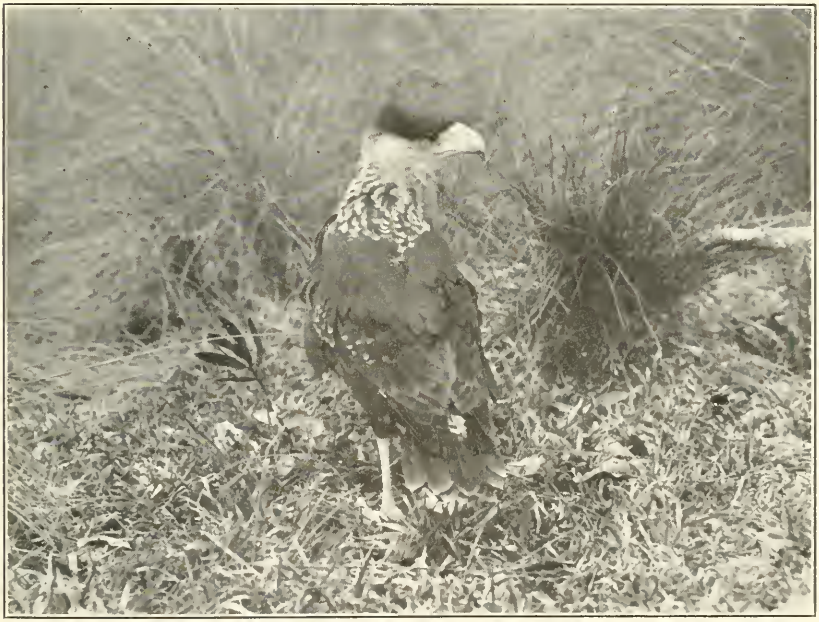
Florida. D. J. Nicholson.

NEST SITES OF AUDUBON'S CARACARA.



Osceola County, Fla., February 25, 1935. S. A. Grimes.

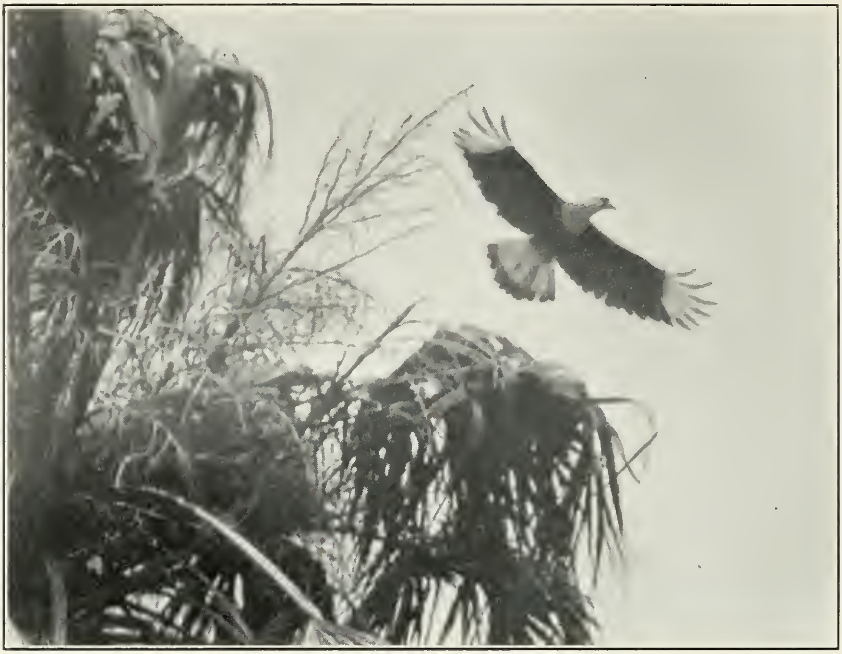
Nest seven feet up in saw palmetto.



Osceola County, Fla., February 25, 1935. S. A. Grimes.

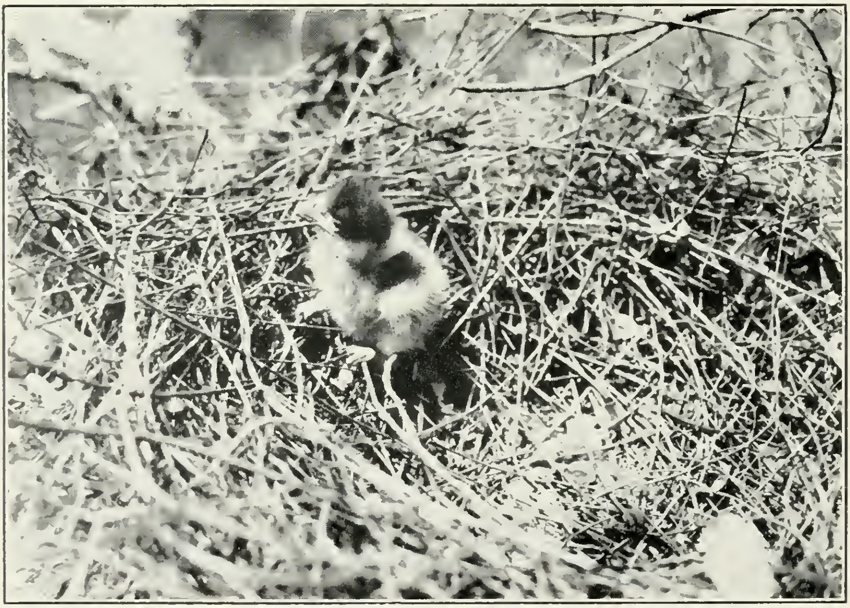
Young in juvenal plumage.

AUDUBON'S CARACARA.



North Indian Field, Fla., April 30, 1924. A. A. Allen.

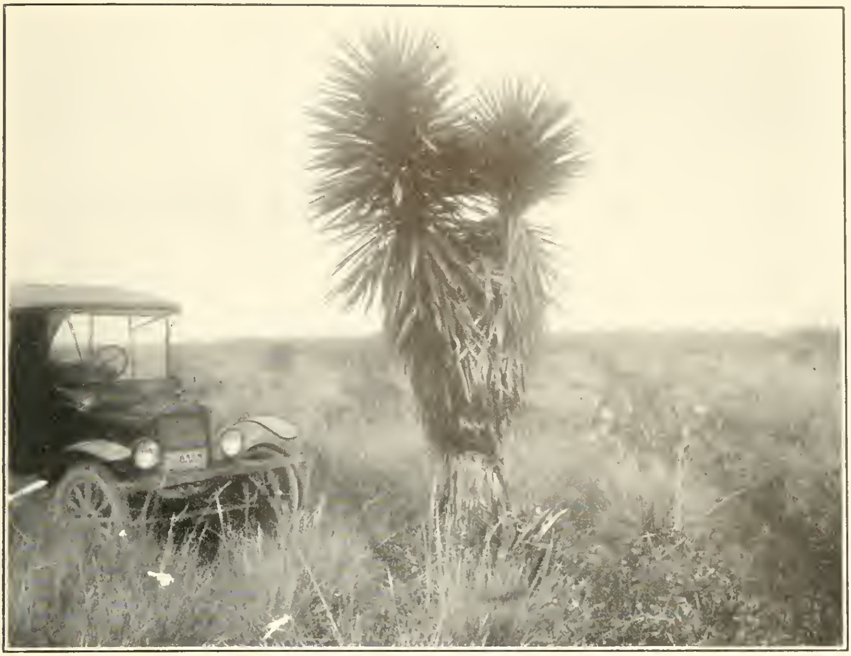
Adult leaving nest.



Florida. W. H. Nicholson.

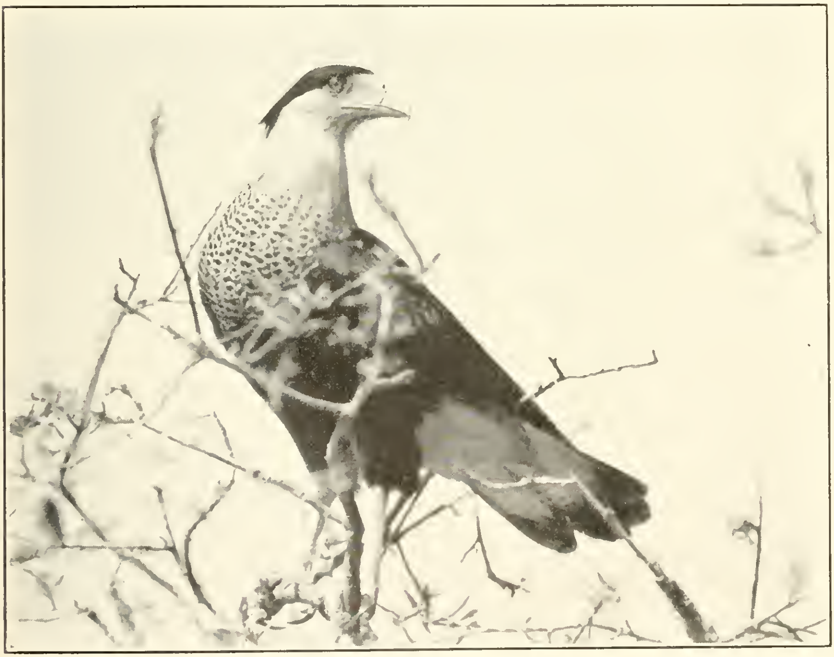
Young about five days old.

AUDUBON'S CARACARAS



Cameron County, Tex., May 24, 1923. A. C. Bent.

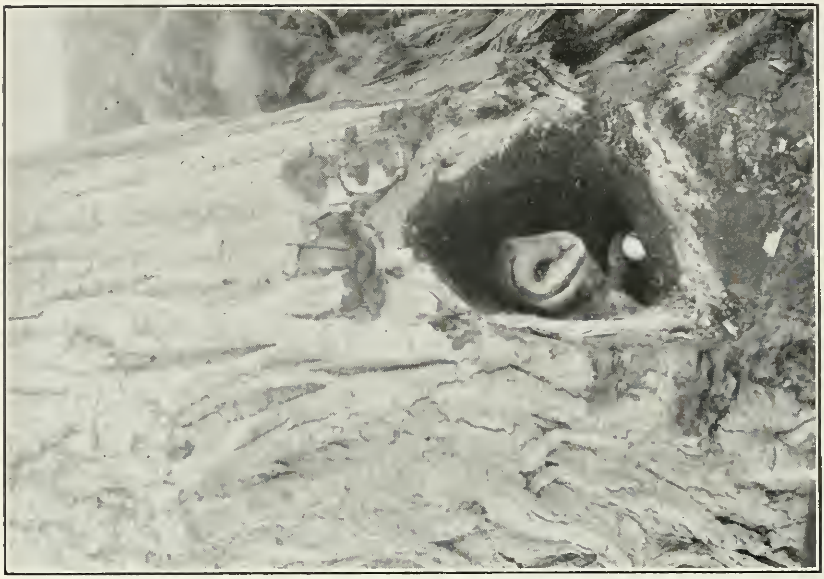
Nesting site.



Osceola County, Fla., March 16, 1935. S. A. Grimes.

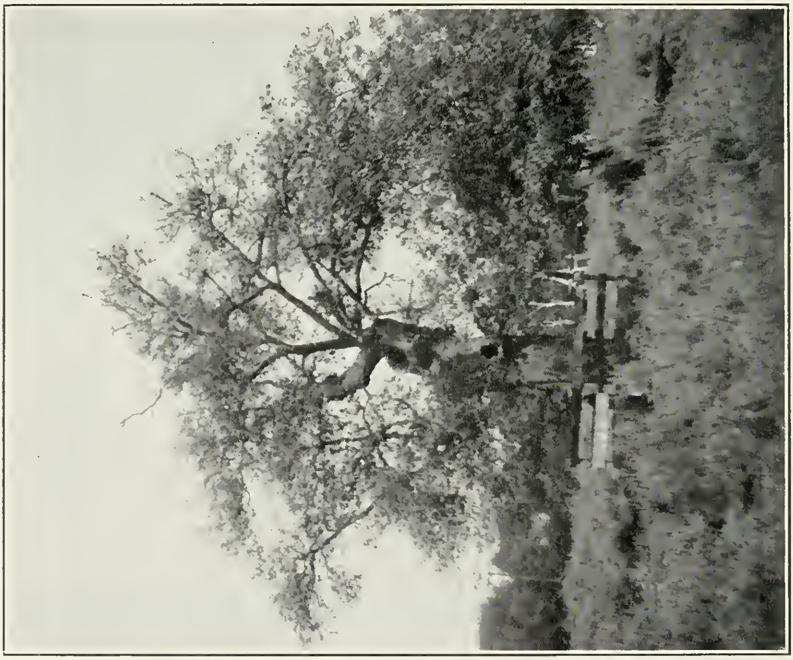
Adult.

AUDUBON'S CARACARA.



San Bernardino County, Calif., April 2, 1916. W. M. Pierce.

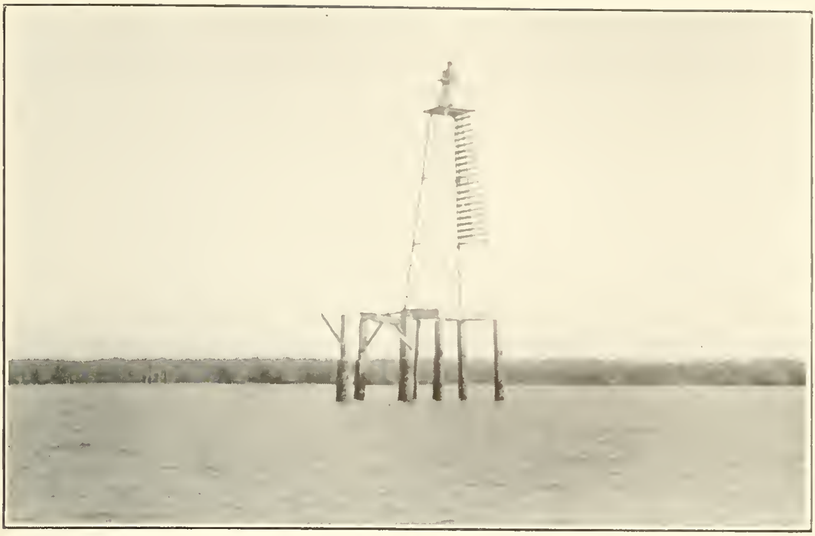
Nesting site at base of tree.



Claremont, Calif., March 10, 1928. E. L. Sumner, Jr.

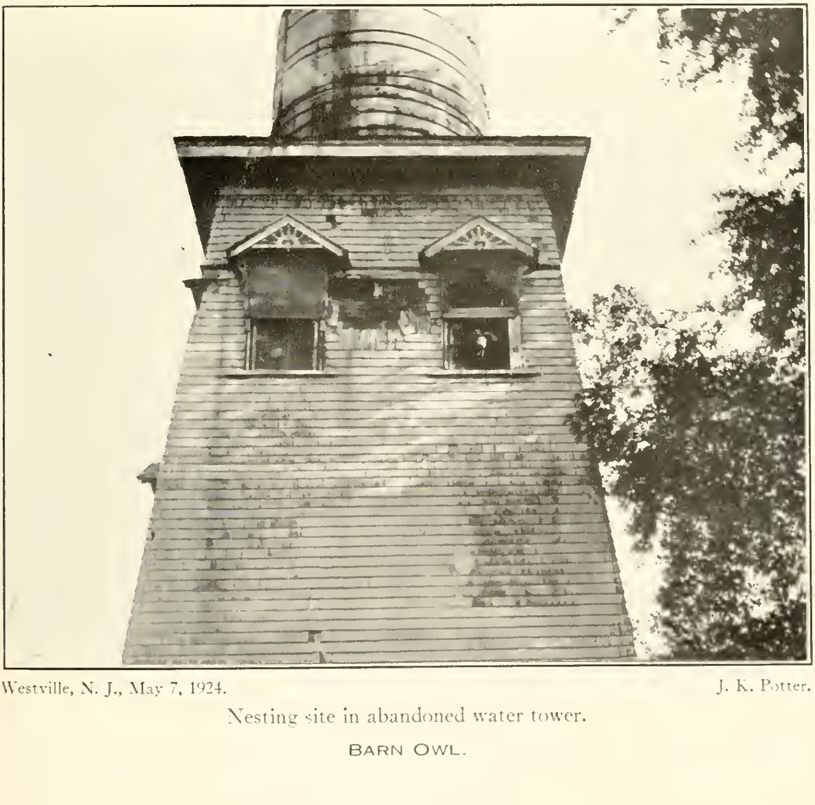
Nesting site in lower cavity.

NESTS OF BARN OWLS.



Near Savannah, Ga. I. R. Tomkins.

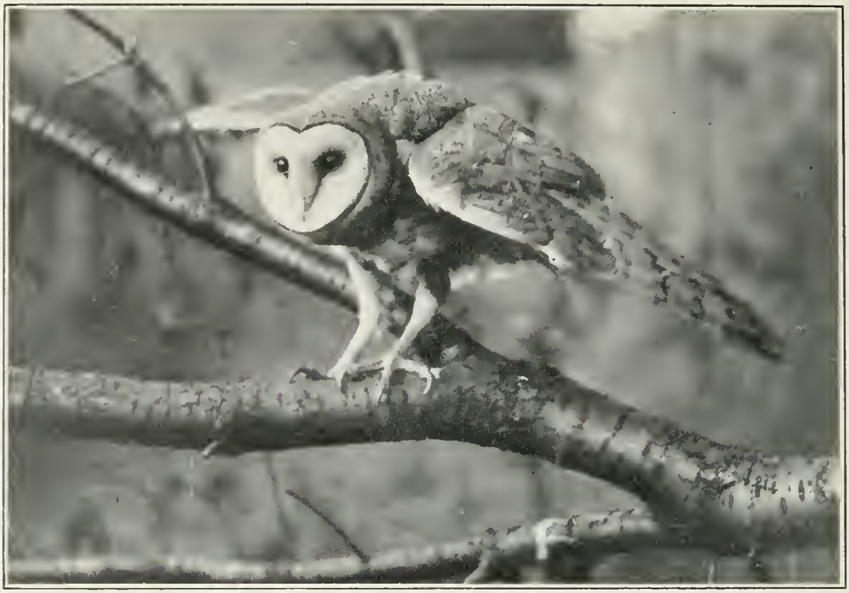
Nesting site in steel box below the light.



Westville, N. J., May 7, 1924. J. K. Potter.

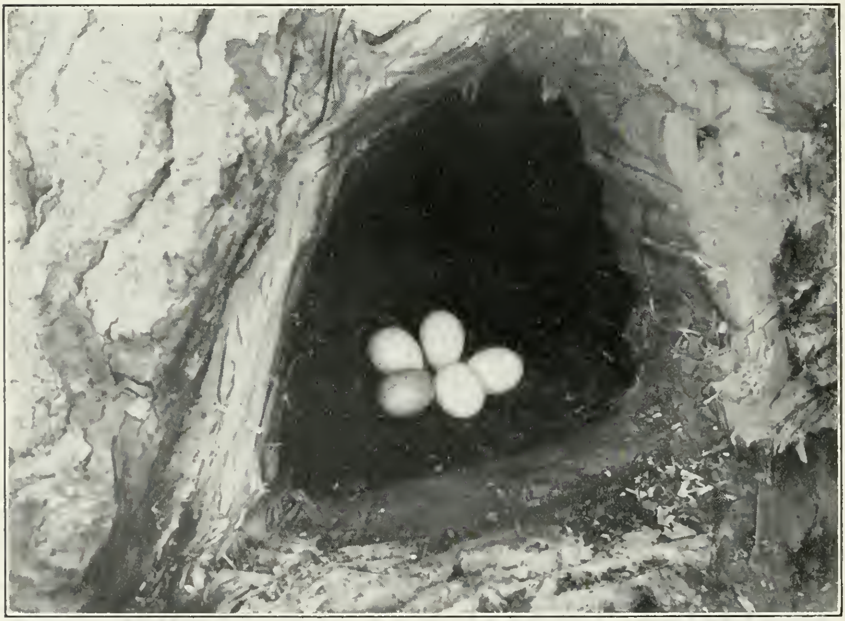
Nesting site in abandoned water tower.

BARN OWL.



West Haven, Conn., November 20, 1912. H. K. Job.

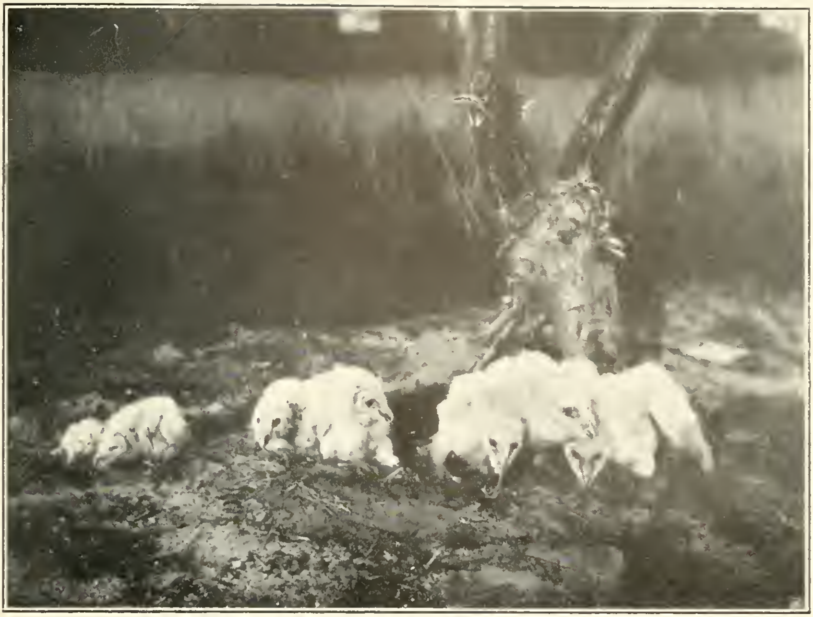
Adult.



San Bernardino County, Calif., April 2, 1916. W. M. Pierce.

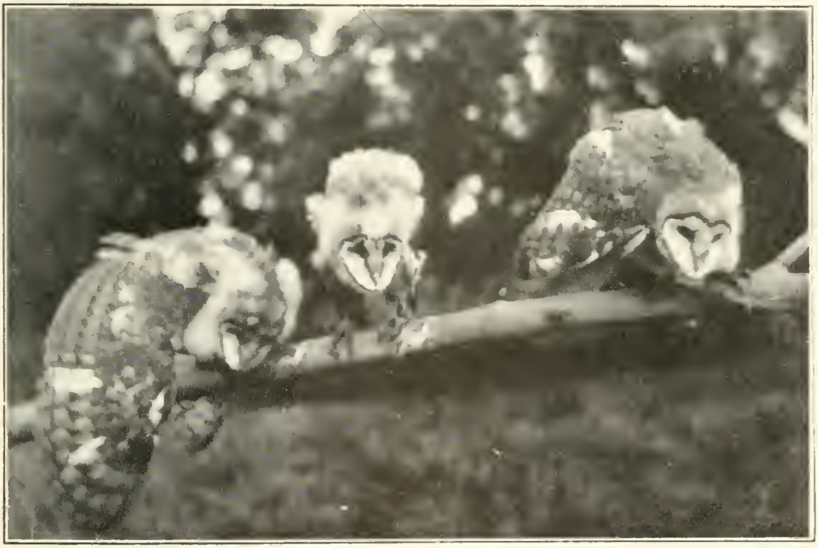
Nest in tree cavity, cut open.

BARN OWL.



Westville, N. J., May 7, 1924. J. K. Potter.

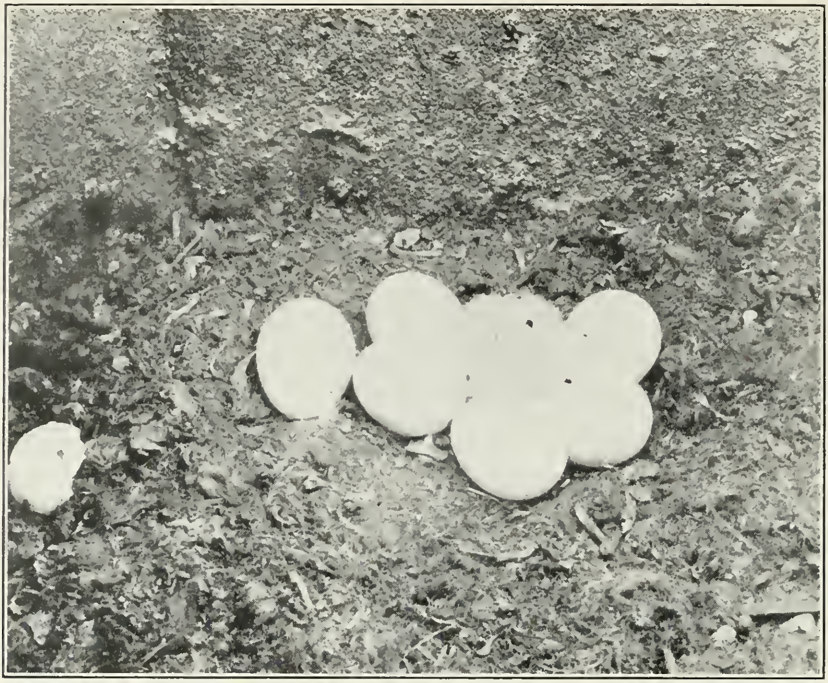
Brood three days to two weeks old.



Westville, N. J., June 9, 1929. J. K. Potter.

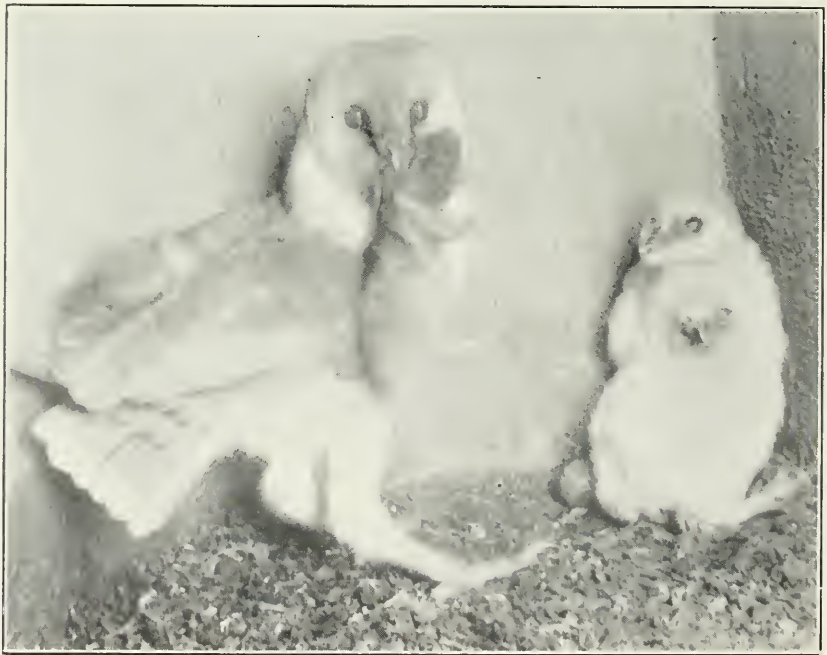
About six weeks old.

YOUNG BARN OWLS



San Jose, Calif., March 12, 1928. G. B. Pickwell.

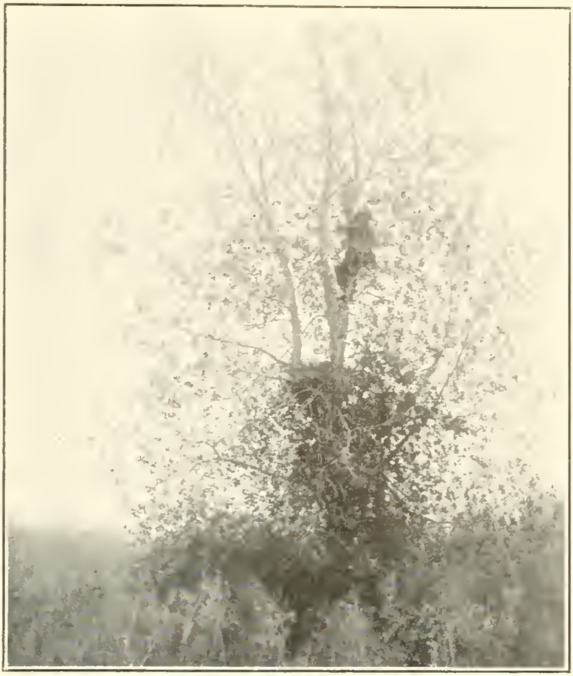
Nest in window casement of a tower.

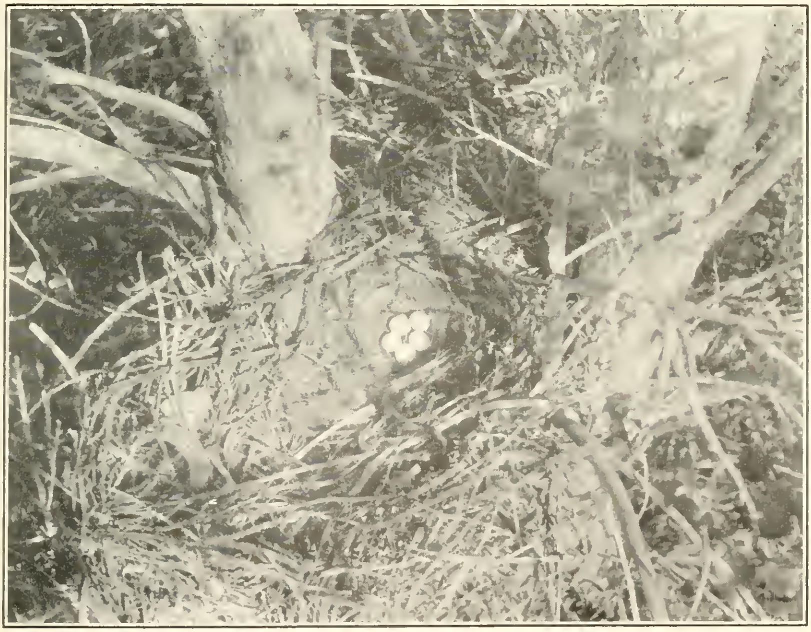


San Jose, Calif., April 5, 1928. G. B. Pickwell.

Adult with pocket gopher for the young.

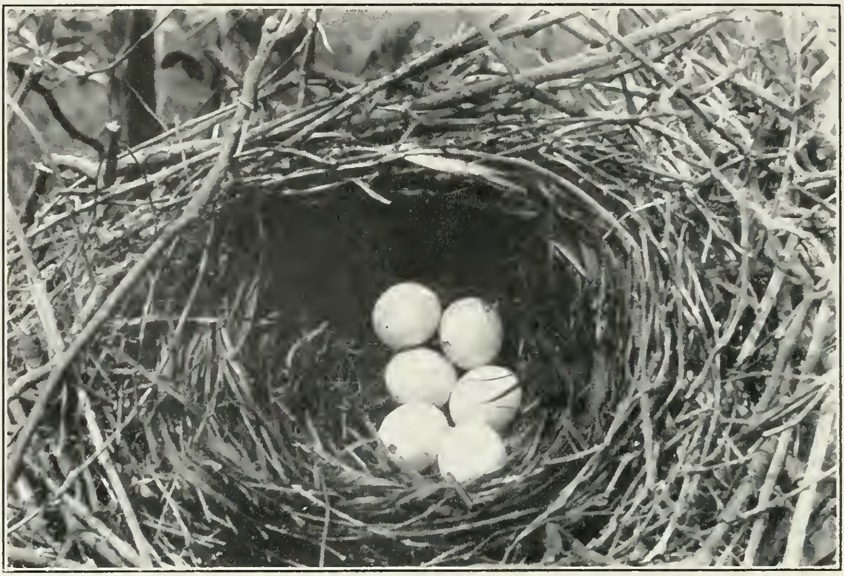
BARN OWLS.



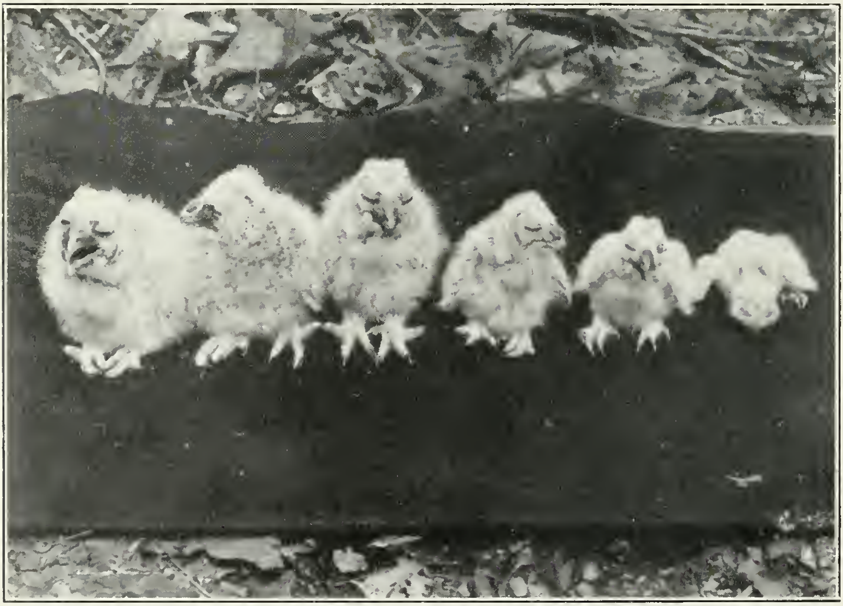


Crane Lake, Saskatchewan, June 3, 1905. A. C. Bent.

NEST OF LONG-EARED OWL IN OLD NEST OF FERRUGINOUS ROUGHLEG.



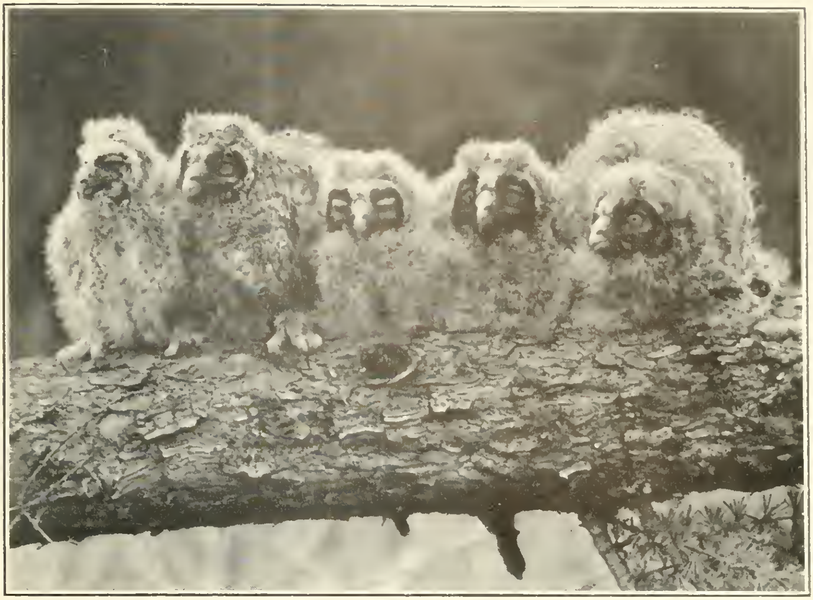
Nest in old crow's nest.



Near Kansas City, Mo. A. H. Cordier.

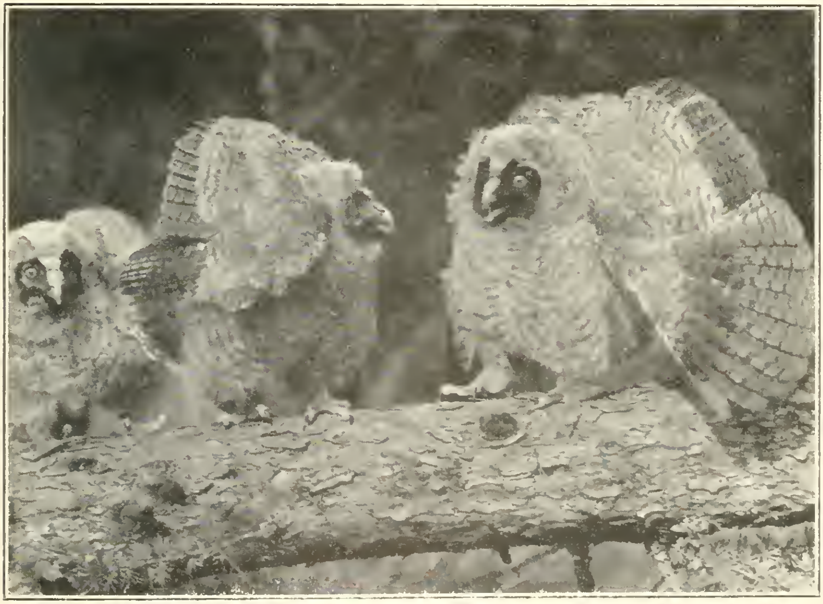
Brood of downy young.

LONG-EARED OWLS.



Hennepin County, Minn., June 1, 1929. S. A. Grimes.

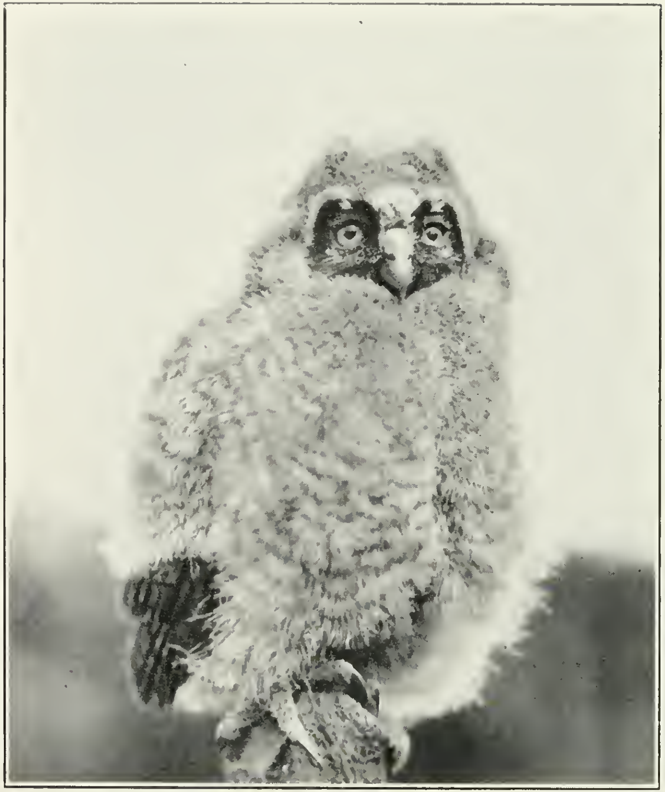
Fledglings at different ages.



Hennepin County, Minn., June 1921. S. A. Grimes.

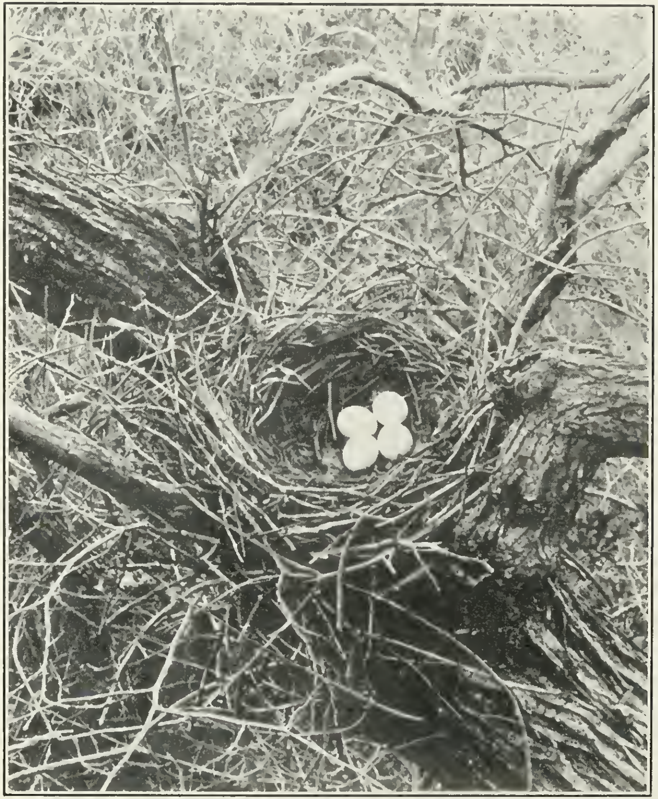
Young in defense reaction.

LONG-EARED OWLS.



Kamloops, British Columbia, July 4, 1930. Eric Hearle.

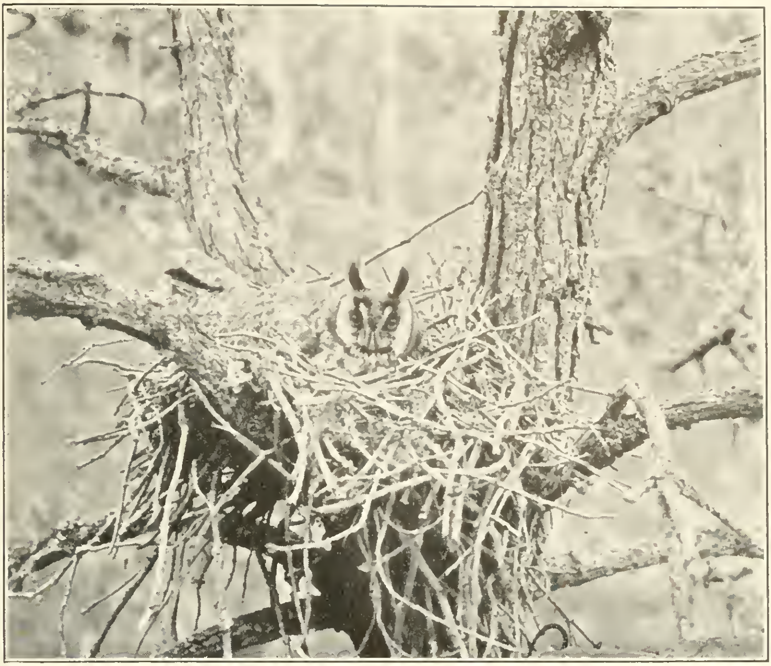
Fledgling.



Bismarck, N. Dak., May 15, 1921. R. Reid.

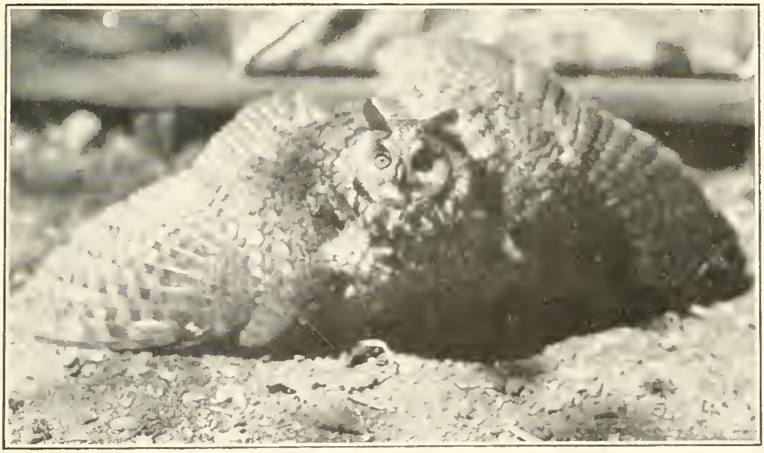
Nest in old crow's nest.

LONG-EARED OWL.



Near Winnipeg, Manitoba. A. G. Lawrence.

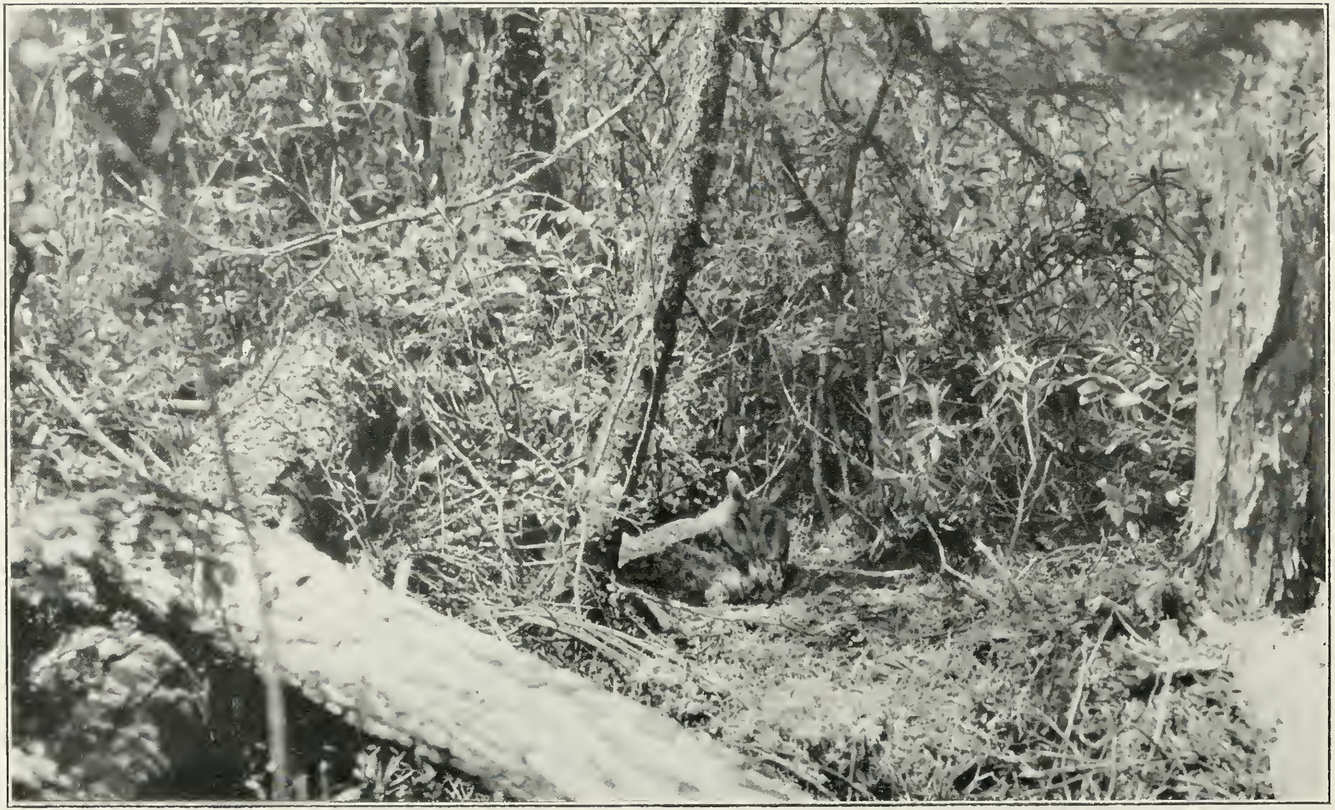
Adult on nest.



Salt Lake City, Utah, May 11, 1929. J. W. Sugden.

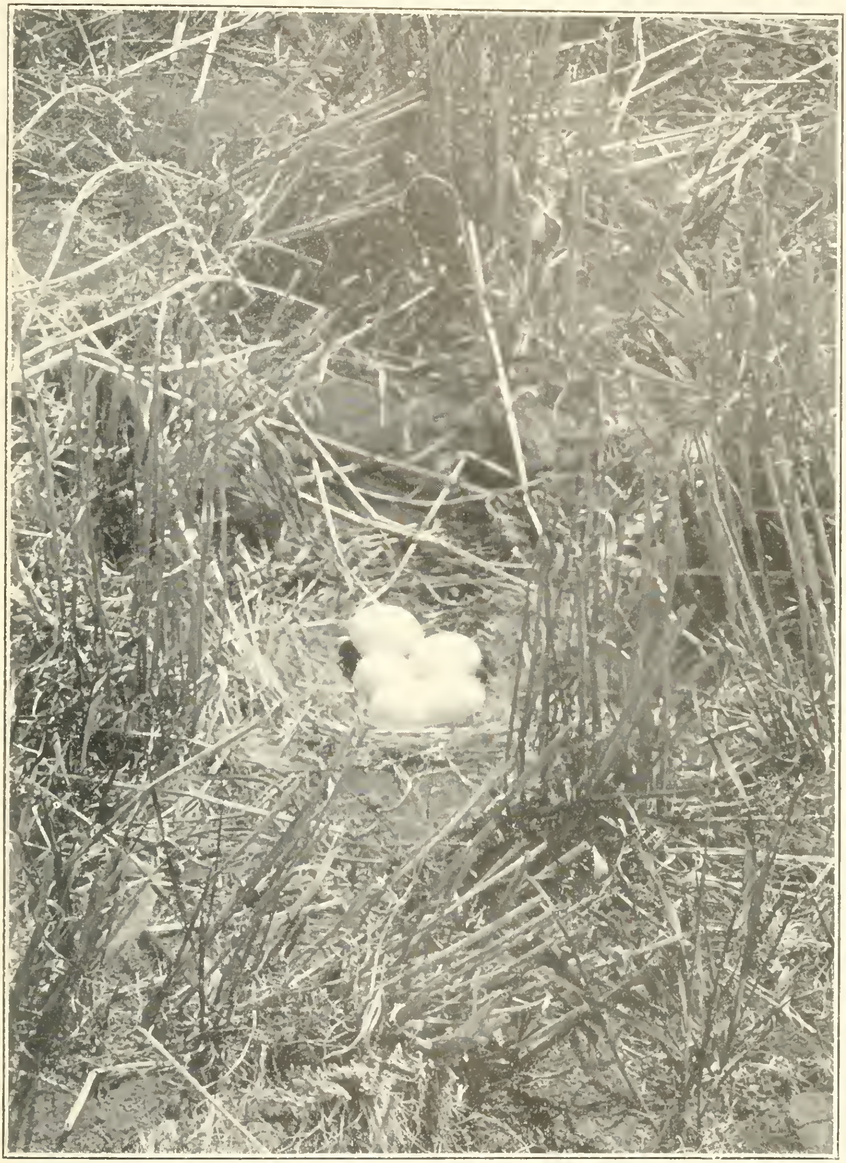
Defense reaction.

LONG-EARED OWLS.



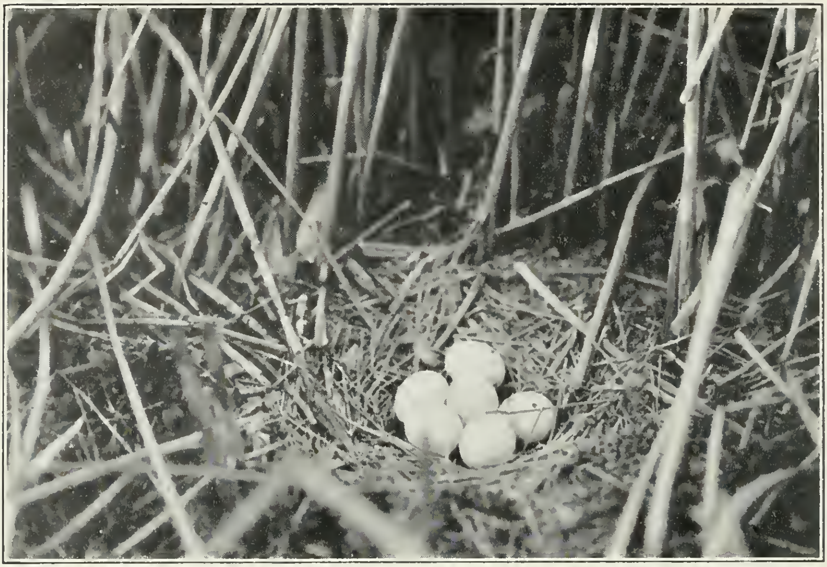
Laurentian Hills, Quebec, June 16, 1928. L. M. Terrill.

LONG-EARED OWL NESTING ON THE GROUND.

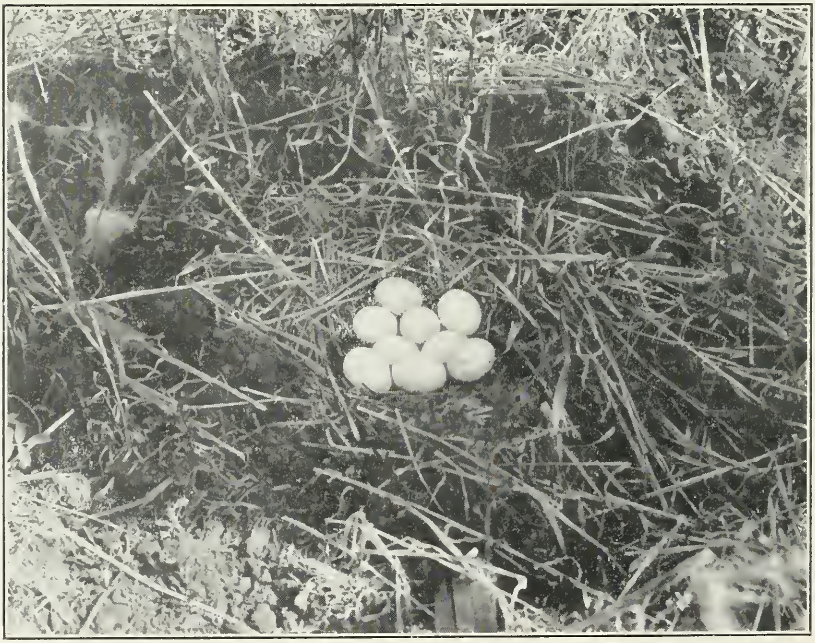


Teton County, Mont., June 13, 1918. A. D. DuBois.

SHORT-EARED OWL'S NEST IN WHEAT STUBBLE.

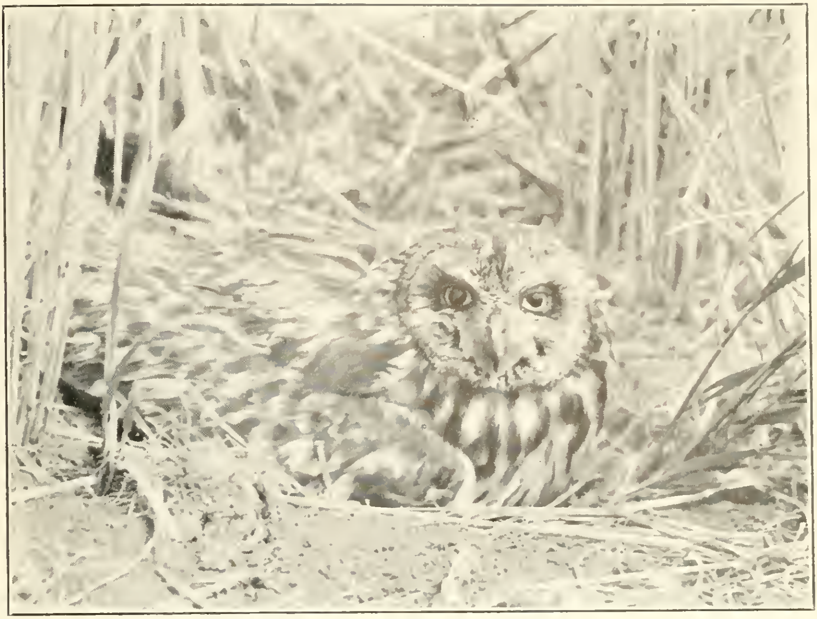


Utah County, Utah, April 24, 1926. R. G. Bee.



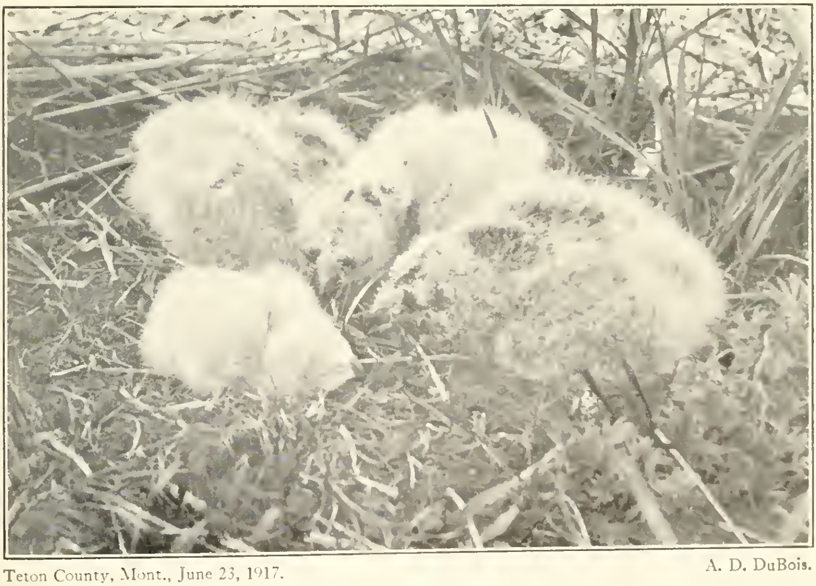
Estlin, Saskatchewan. W. A. Goelitz.

NESTS OF SHORT-EARED OWLS.



Teton County, Mont., June 13, 1918. A. D. DuBois.

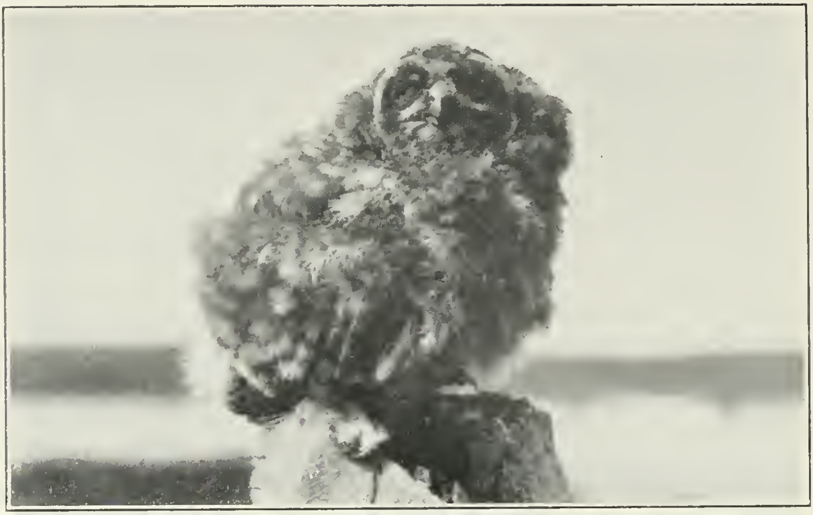
Adult on nest.



Teton County, Mont., June 23, 1917. A. D. DuBois.

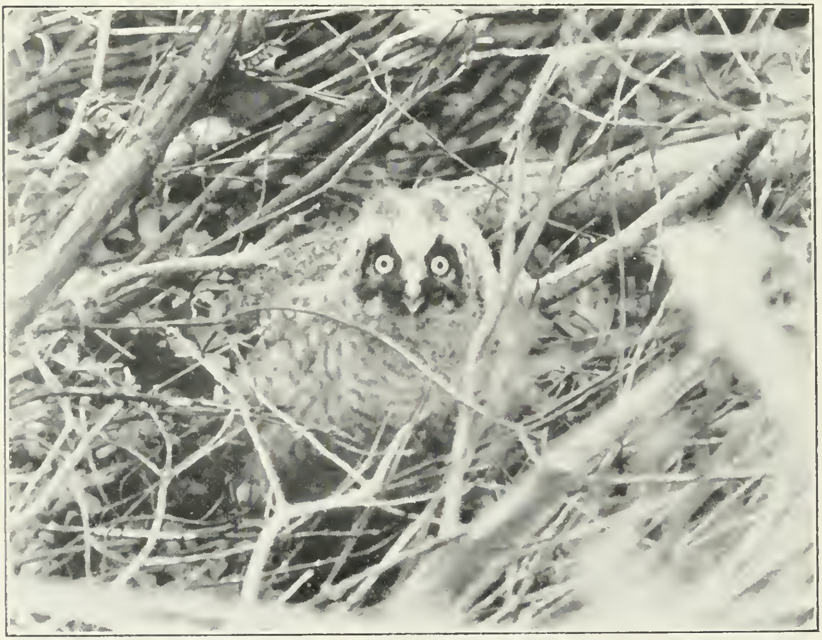
Young of different ages.

SHORT-EARED OWLS.



Delta, Manitoba, May 23, 1927. A. B. Gresham.

Large downy young.



Marthas Vineyard, Mass., May 23, 1899. O. Durfee.

Young in juvenal plumage.

SHORT-EARED OWLS.

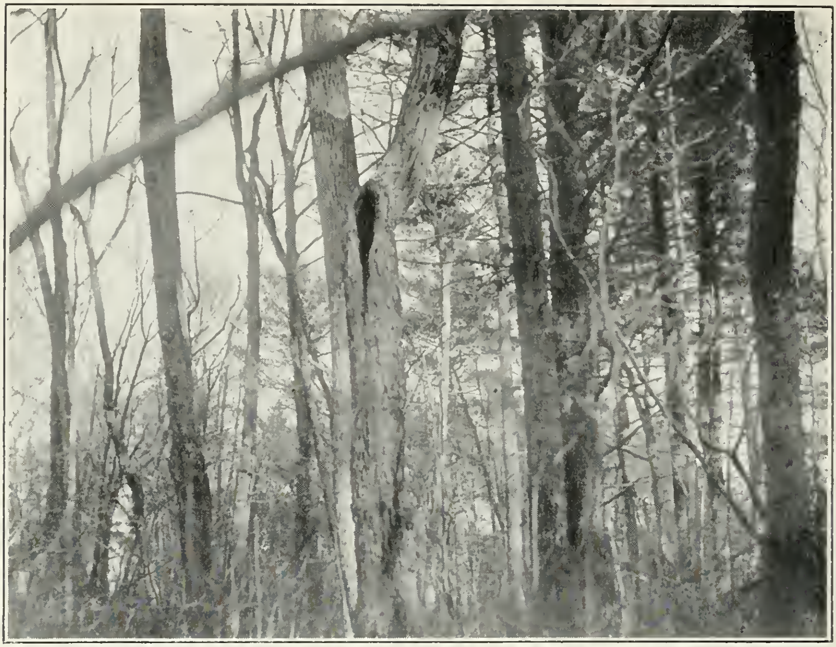
Taunton, Mass., April 8, 1905. A. C. Bent.

Nesting site.

Middleboro, Mass., April 4, 1914. A. C. Bent.

Community nest.

NESTING OF NORTHERN BARRED OWLS



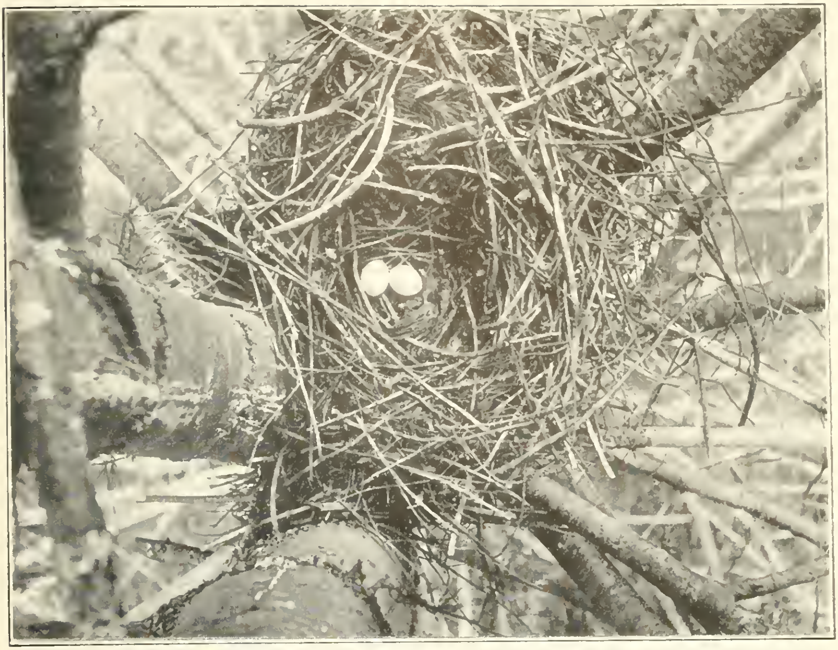
Middleboro, Mass., March 23, 1902. O. Durfee.

Where the author was trapped.

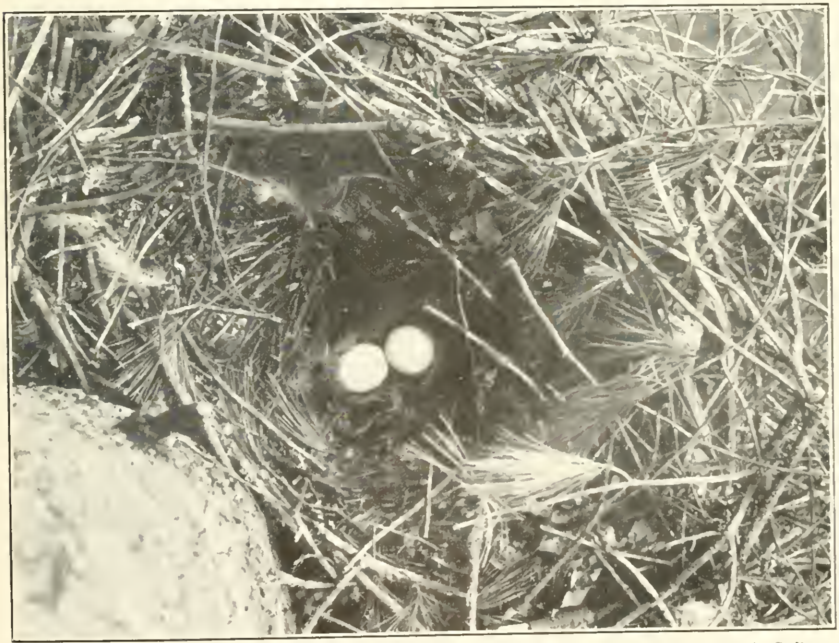
Taunton, Mass., May 2, 1909. A. C. Bent.

Adult on nest.

NESTING OF NORTHERN BARRED OWLS.

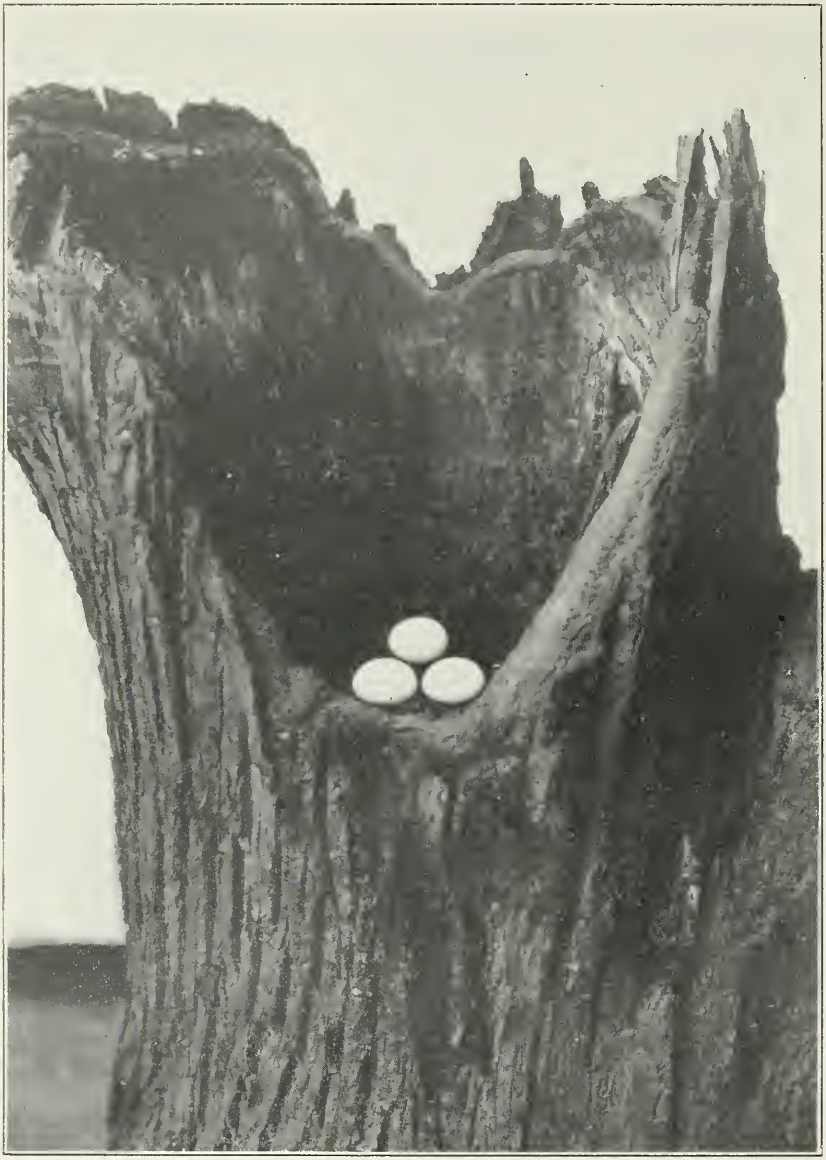


Canton, Mass., May 11, 1902 O. Durfee.



Taunton, Mass., April 8, 1905. A. C. Bent.

NESTS OF NORTHERN BARRED OWLS.



Wayne County, Mich. J. B. Purdy.

NEST OF NORTHERN BARRED OWL.

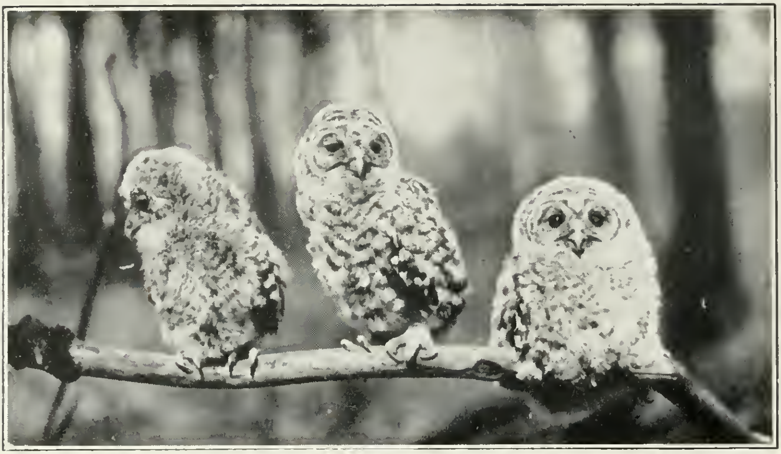
Taunton, Mass., May 7, 1905. A. C. Bent.

Two young recently hatched.

Taunton, Mass., May 21, 1905. A. C. Bent.

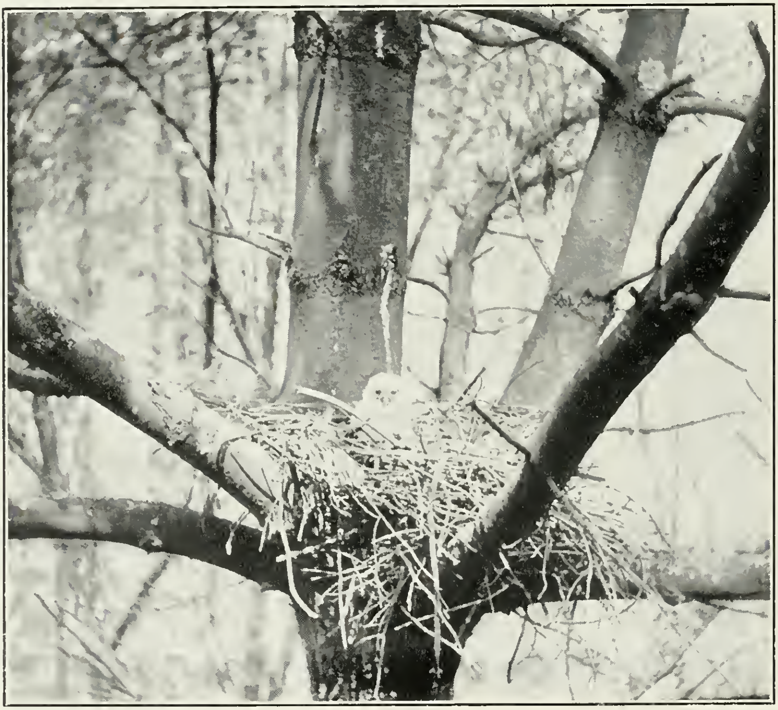
About two weeks old.

YOUNG NORTHERN BARRED OWLS.



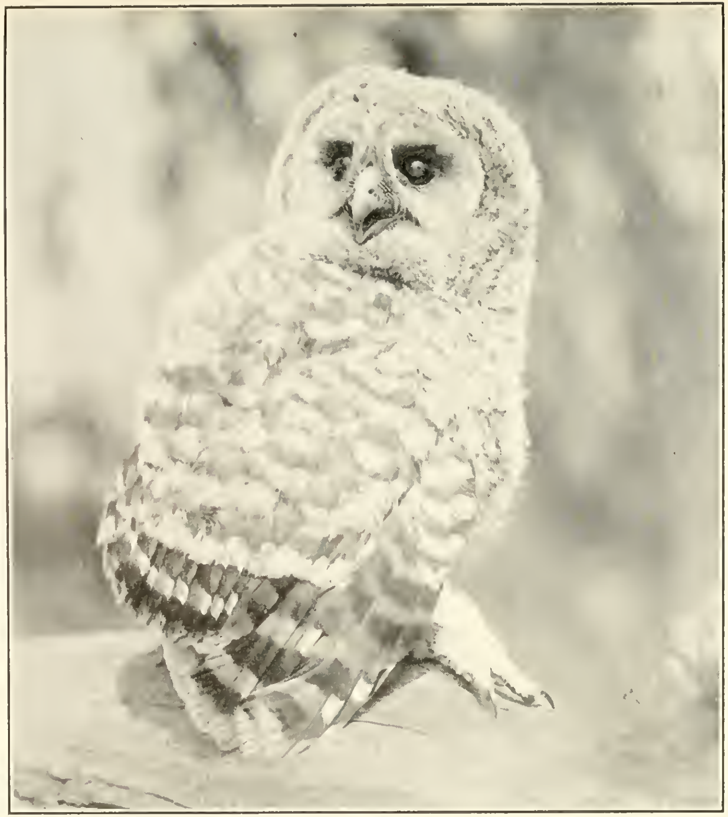
Genesee County, Mich., May 3, 1927. B. East.

Of different ages.



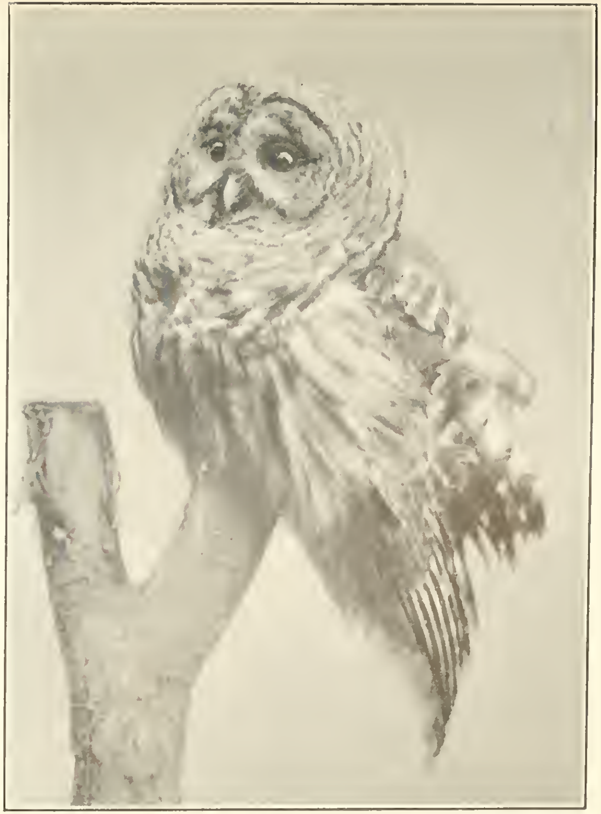
Bridgewater, Mass., May 26, 1924. A. C. Bent.

YOUNG NORTHERN BARRED OWLS.



Jamestown, N. Y., May 4, 1925. R. T. Peterson.

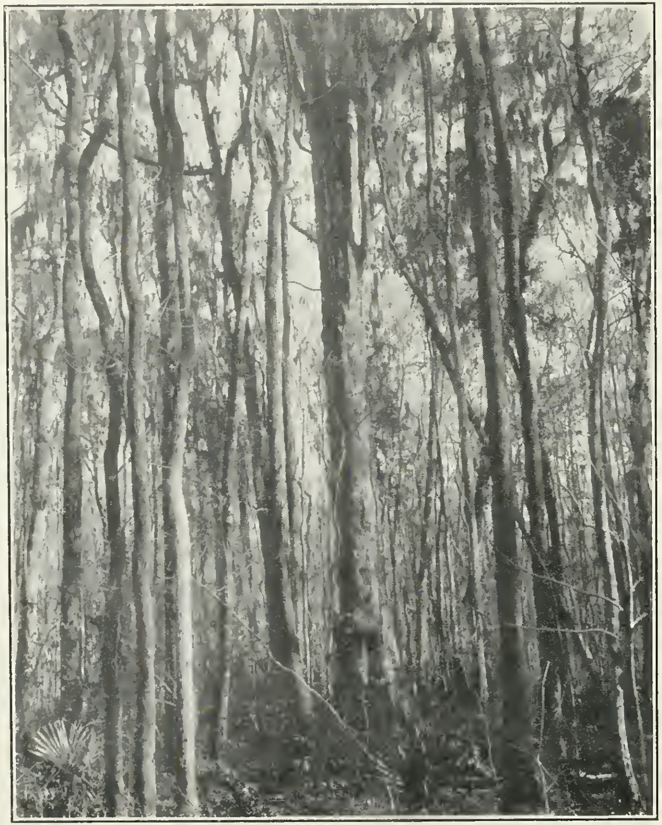
Young in juvenal plumage.



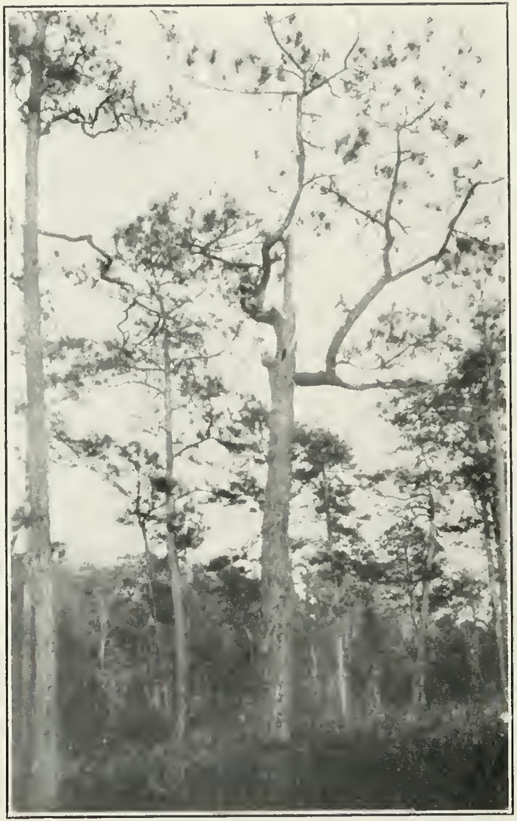
Columbus, Ohio. E. S. Thomas.

Adult.

NORTHERN BARRED OWLS.

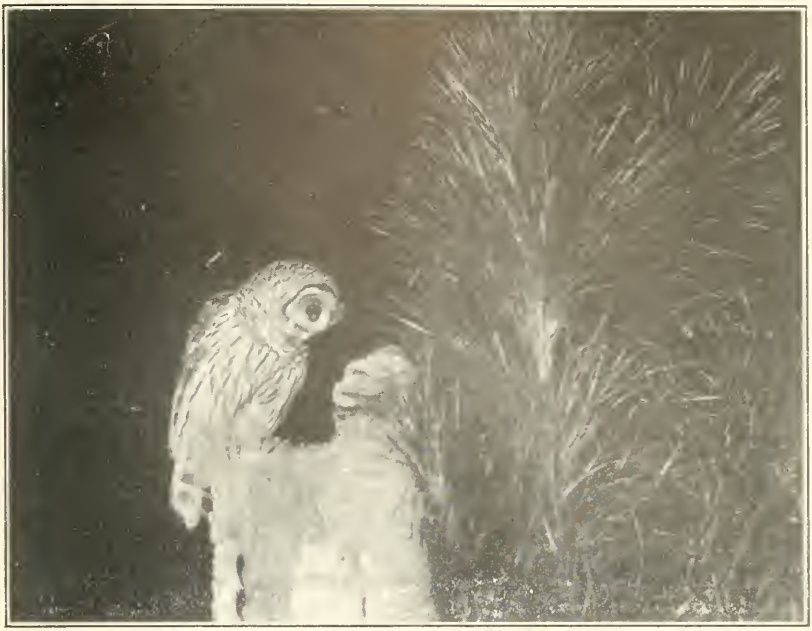


Duval County, Fla., January 11, 1931. S. A. Grimes.



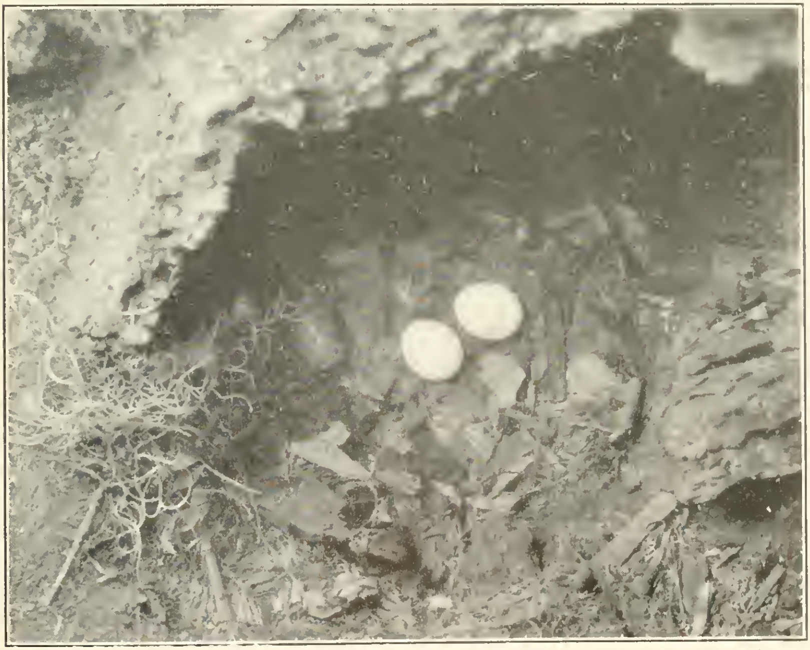
Orange County, Fla., March 5, 1925. D. J. Nicholson.

NESTING SITES OF FLORIDA BARRED OWLS.



Duval County, Fla., March 29, 1936. S. A. Grimes.

Adult at nest.



Duval County, Fla., February 5, 1931. S. A. Grimes.

NESTS OF FLORIDA BARRED OWLS.

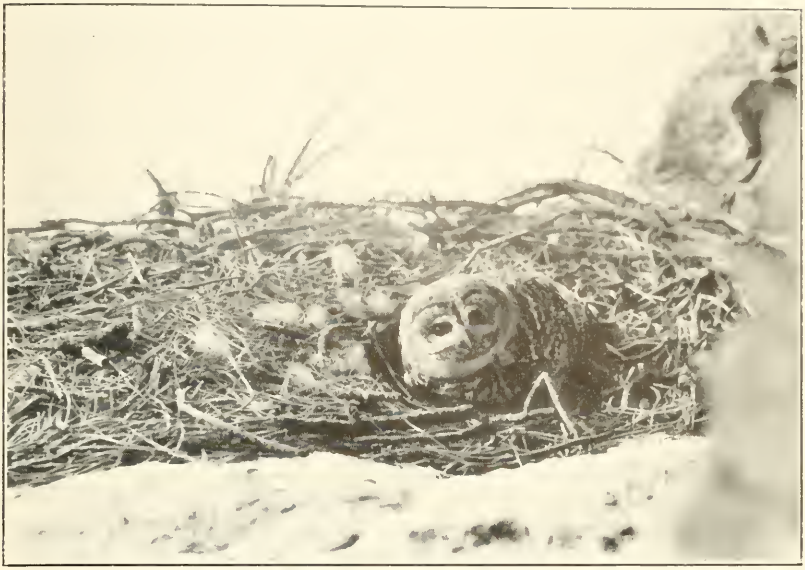
Ventura County, Calif., April 1, 1929.

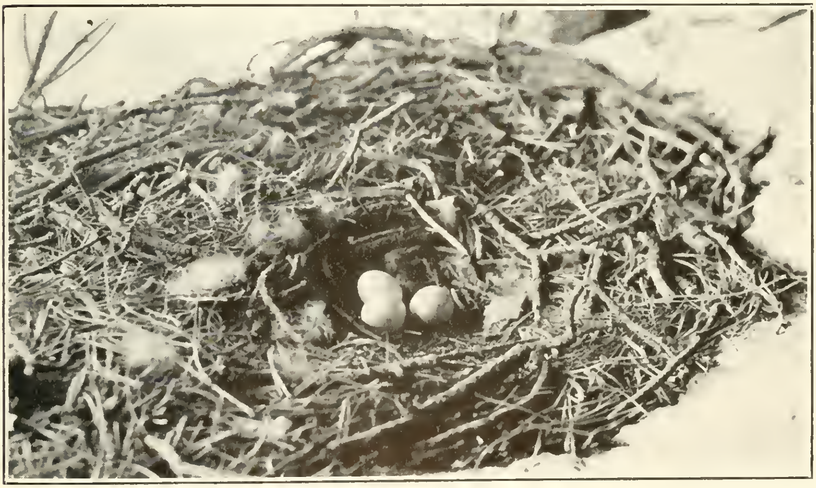
Adult on nest, lower center.

A. C. Bent.

Canyon nesting site.

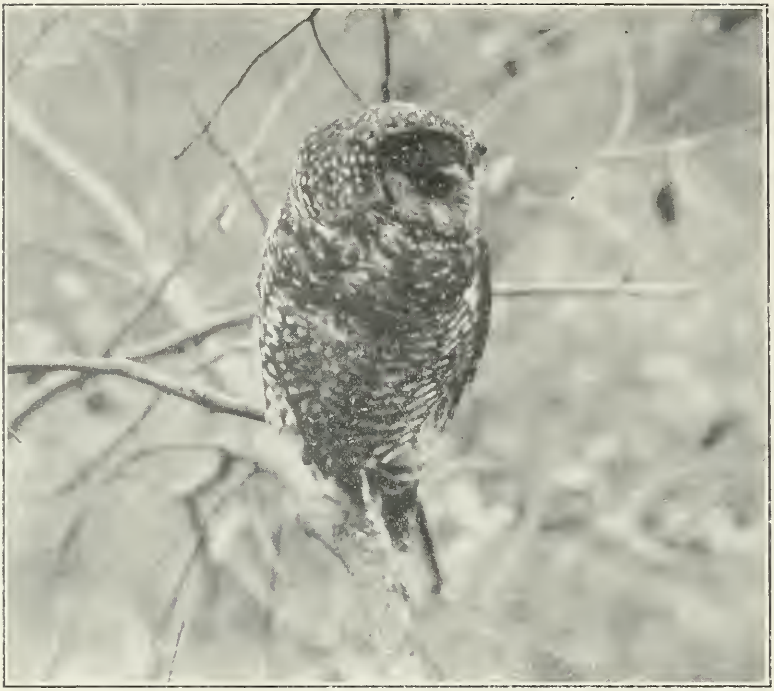
NESTING OF CALIFORNIA SPOTTED OWL.



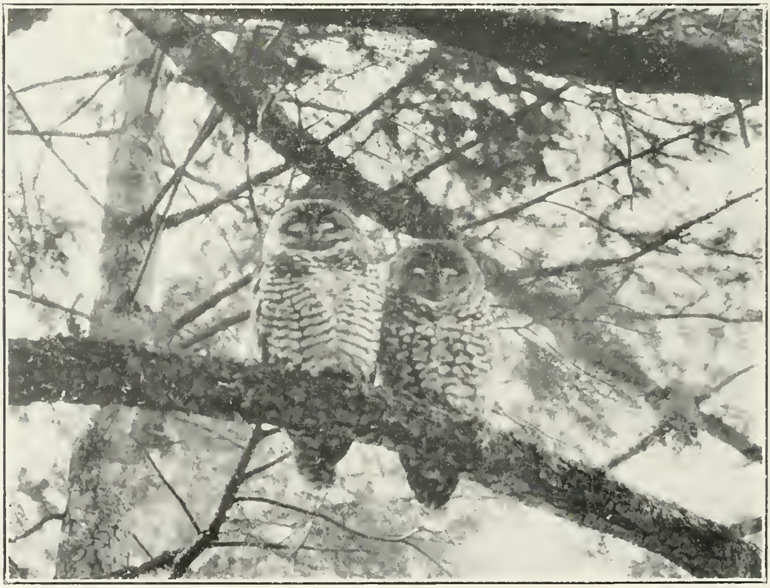


New Mexico, April 9, 1925. J. S. Ligon.

MEXICAN SPOTTED OWL AND NEST.

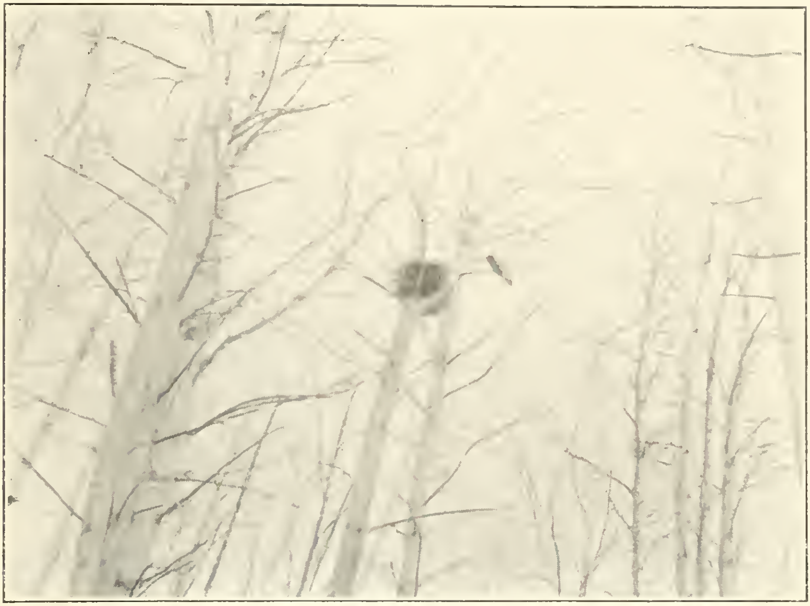


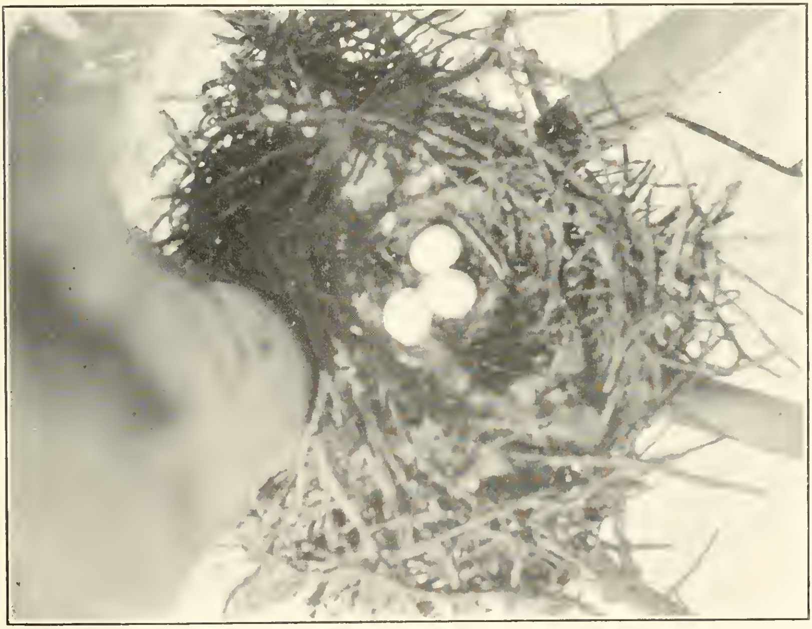
Claremont, Calif. W. M. Pierce.



New Mexico. J. S. Ligon.

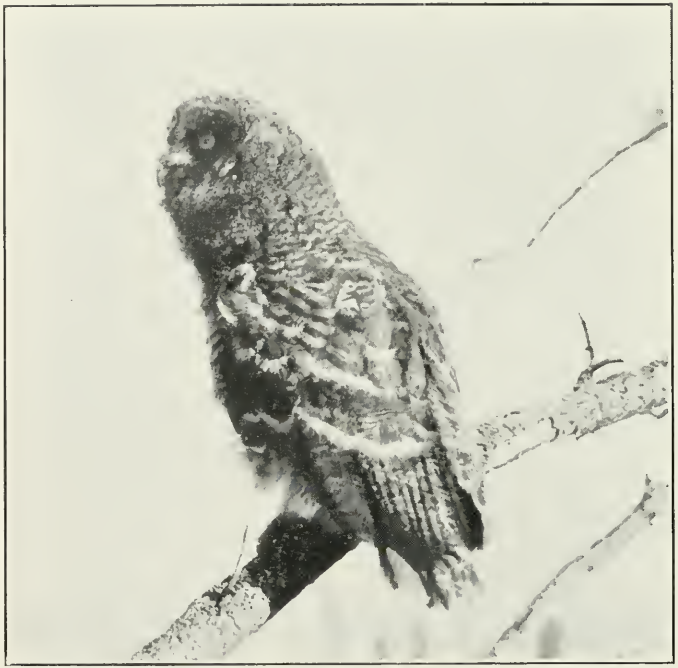
SPOTTED OWLS.





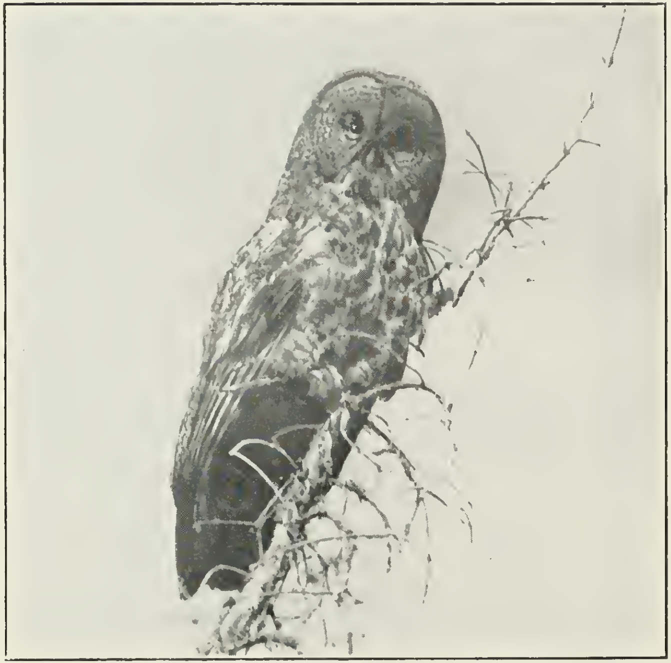
Near Belvedere, Alberta, March 23, 1913. A. D. Henderson.

NESTING SITE AND NEST OF GREAT GRAY OWL.



Near Fairbanks, Alaska, June 23, 1922.
Courtesy U. S. Biological Survey.

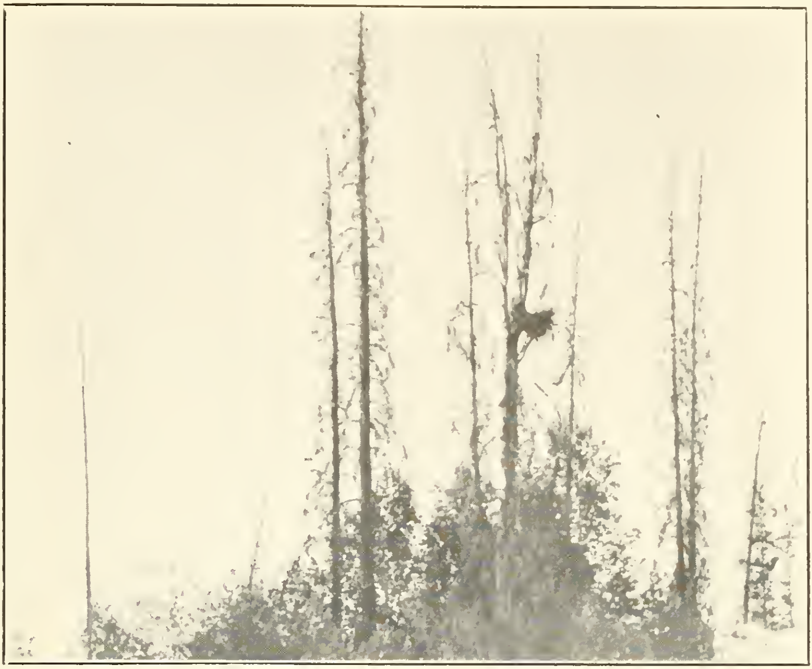
Young in juvenal plumage.



O. J. Murie.

Adult.

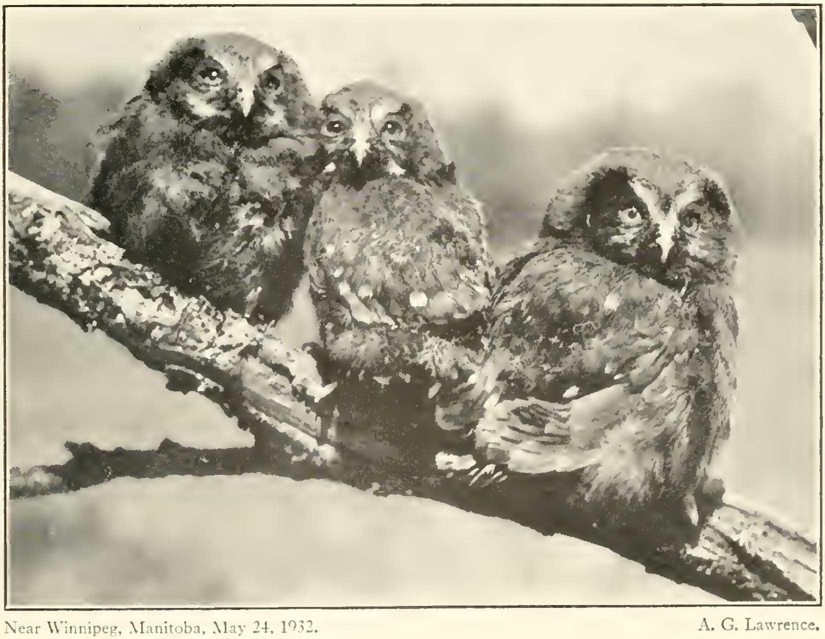
GREAT GRAY OWLS.



Near Fairbanks, Alaska, June 23, 1922.
Courtesy U. S. Biological Survey.

O. J. Murie.

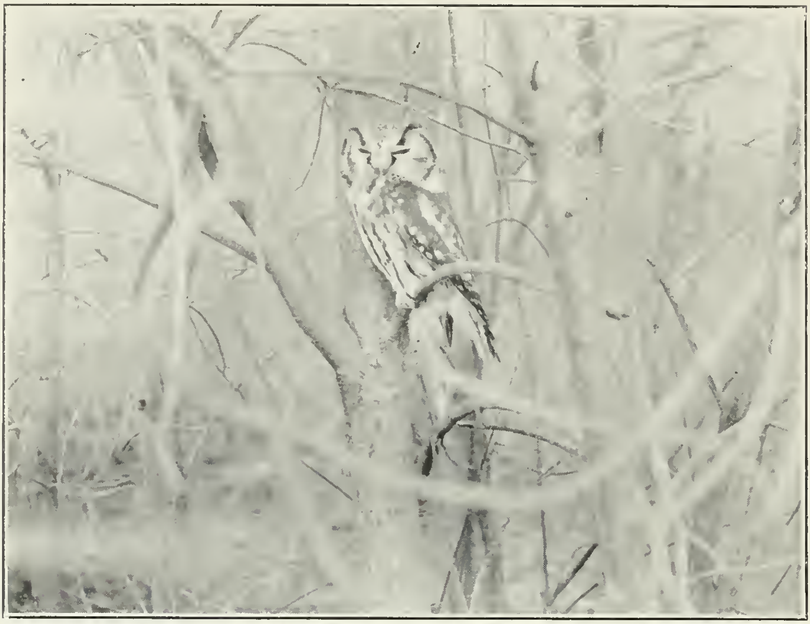
NESTING SITE OF GREAT GRAY OWL.



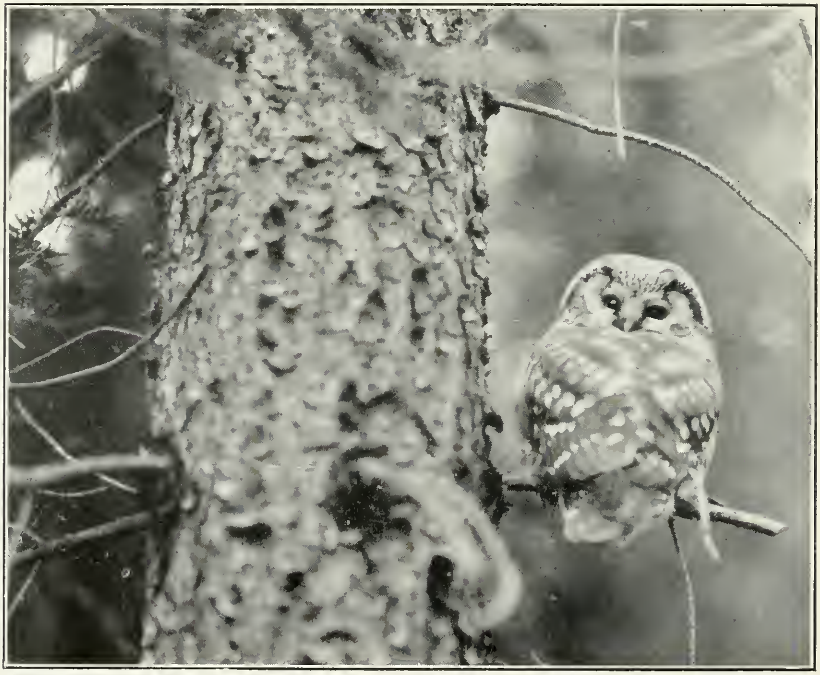
Near Winnipeg, Manitoba, May 24, 1932.

A. G. Lawrence.

YOUNG RICHARDSON'S OWLS IN JUVENAL PLUMAGE



Kittson County, Minn., April. P. B. Peabody.



Banff, Alberta, October 2, 1923. Eric Hearle.

ADULT RICHARDSON'S OWLS.

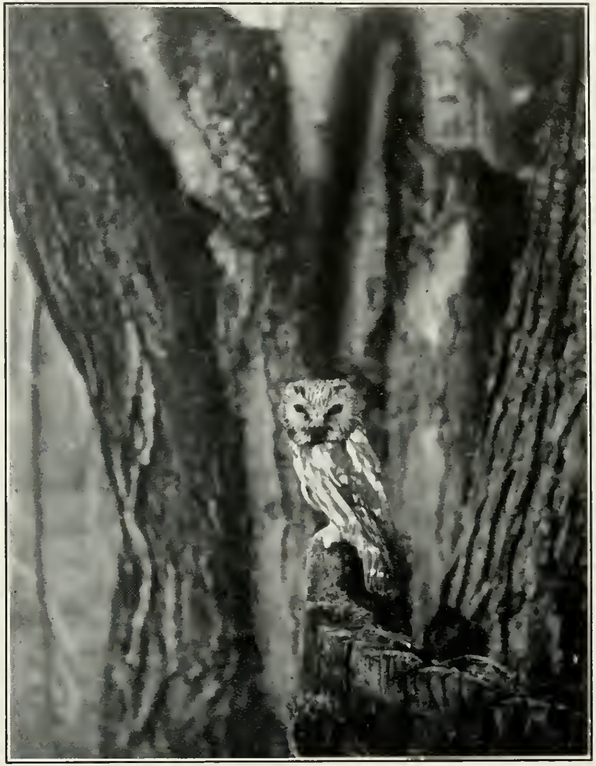
Taunton, Mass., April 10, 1911. A. C. Bent.

C. S. Day interviewing the owl.

NESTING SITE OF SAW-WHET OWL.

Northern Minnesota. P. B. Peabody.

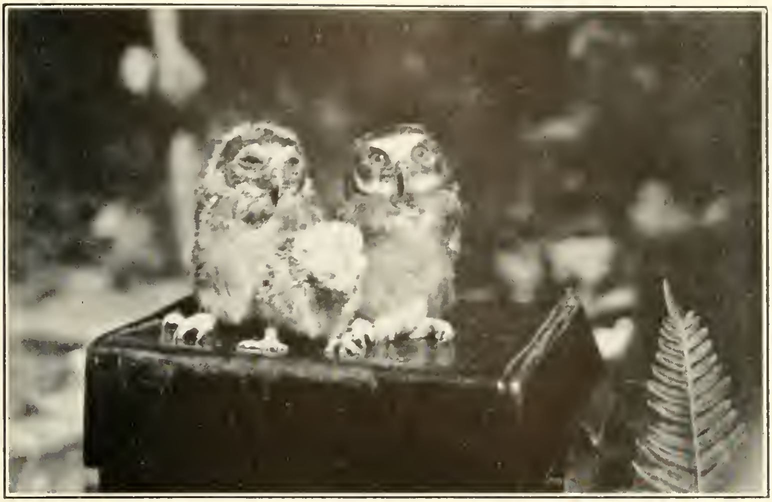
Adult at nest opening.



Lyndonville, N. Y., April 2, 1927. W. A. Smith.

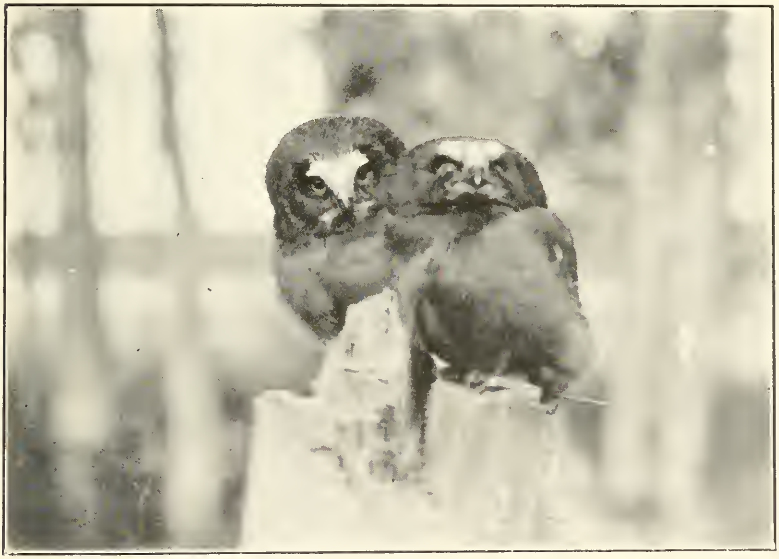
Adult.

SAW-WHET OWLS.



Chambly. Quebec, July 9, 1927. L. M. Terrill.

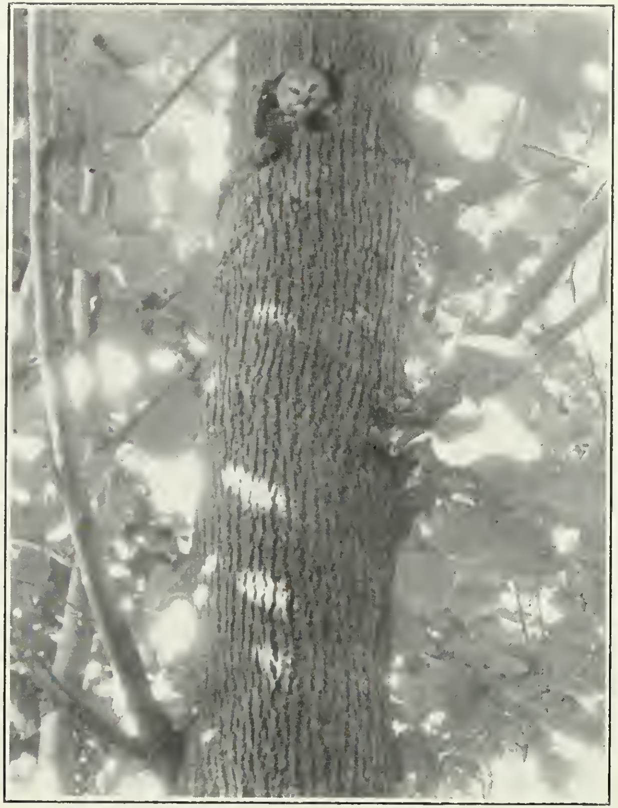
Ten to twenty-one days old.



Lac La Nonne, Alberta, June 25, 1924. R. H. Rauch.

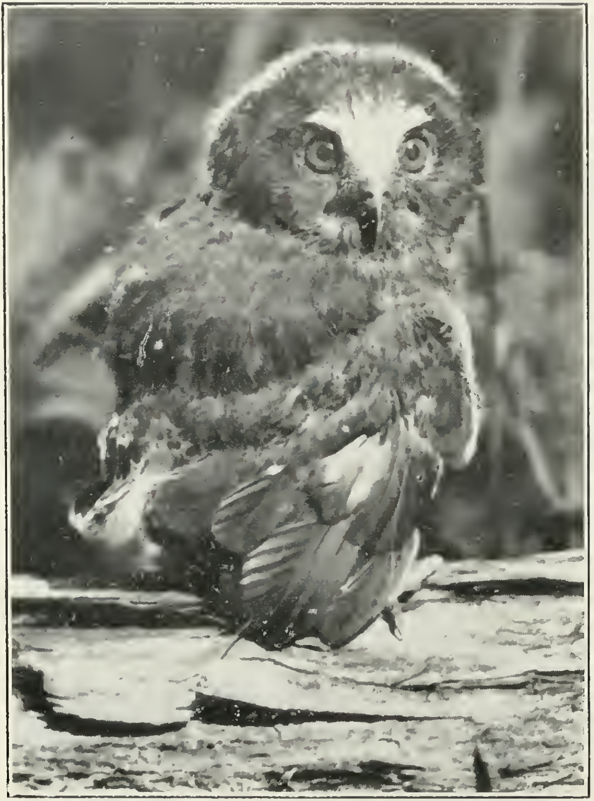
In juvenal plumage.

YOUNG SAW-WHET OWLS.



Chambly, Quebec, July 9, 1927. L. M. Terrill.

Adult at nest hole.



Chambly, Quebec, July 16, 1927. L. M. Terrill.

Young 26 to 28 days old.

SAW-WHET OWLS.

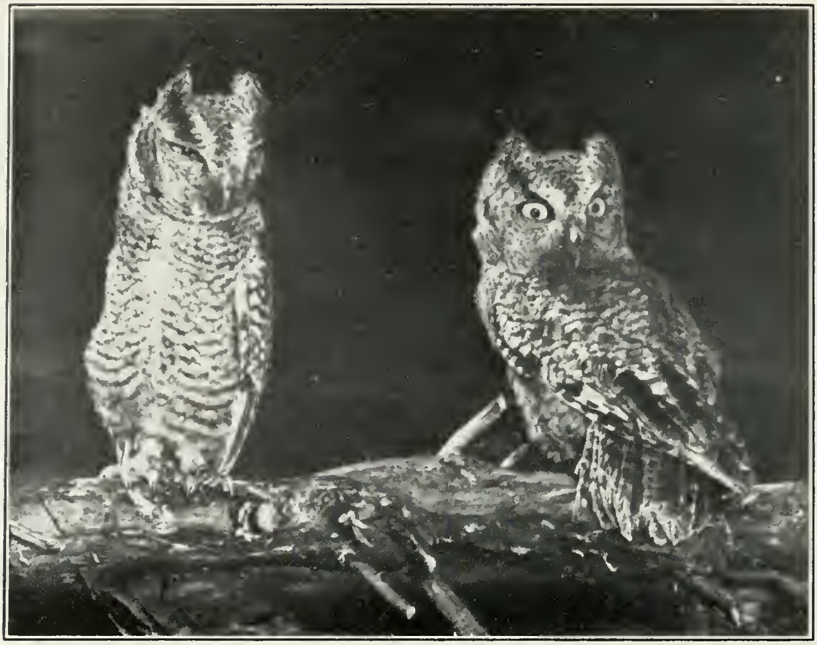
Seekonk, Mass., April 21, 1934. W. G. F. Harris.

Nesting site in apple tree.

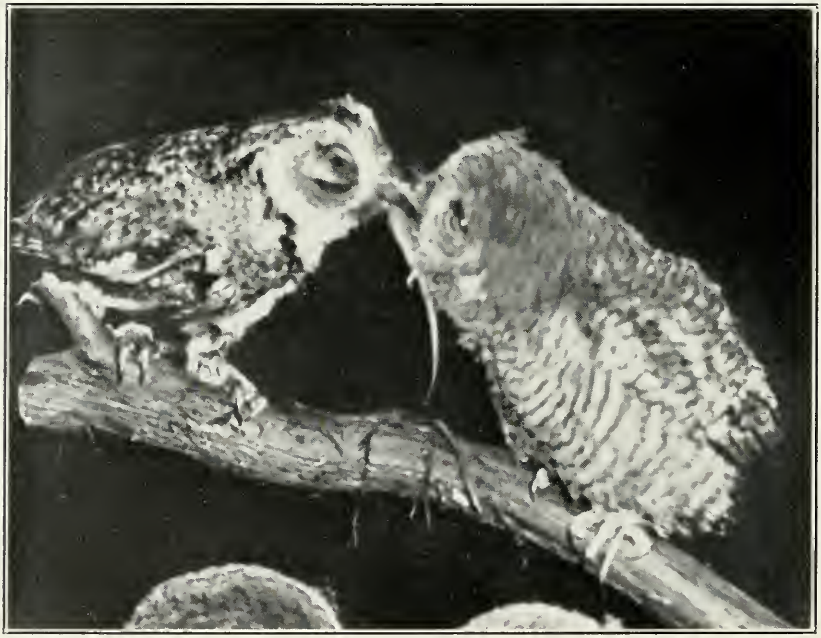
Ithaca, N. Y. A. A. Allen.

Adult in hiding pose.

EASTERN SCREECH OWL.



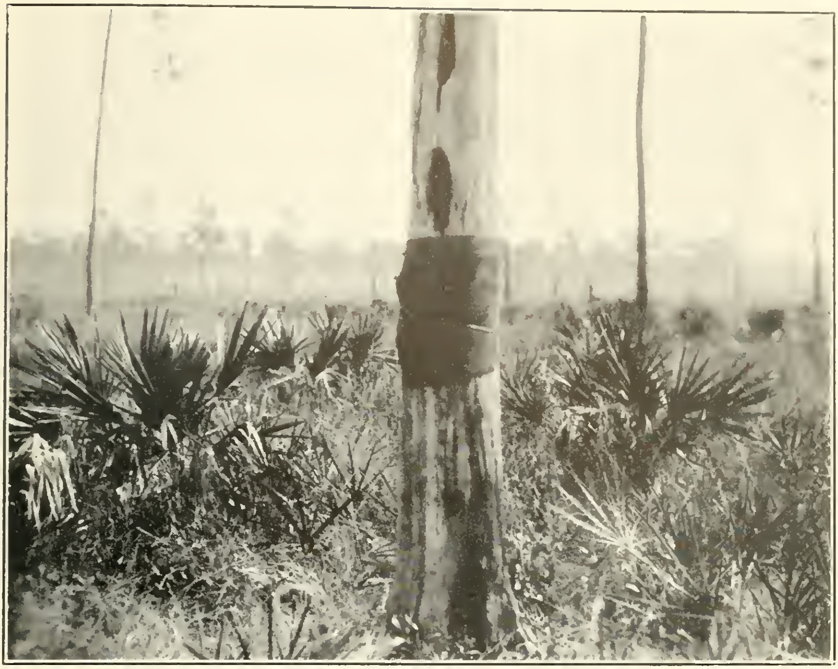
Young in juvenal plumage.



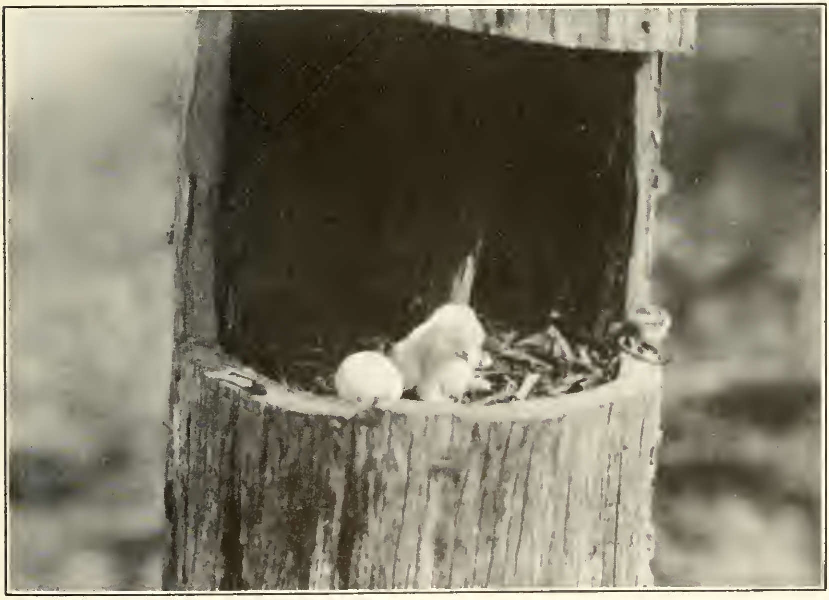
Ithaca, N. Y. A. A. Allen.

Adult feeding young.

EASTERN SCREECH OWLS.

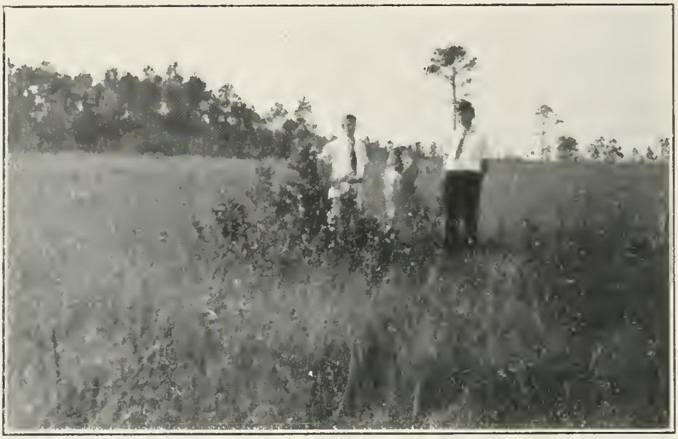


Orange County, Fla., April 7, 1932. W. H. Nicholson.



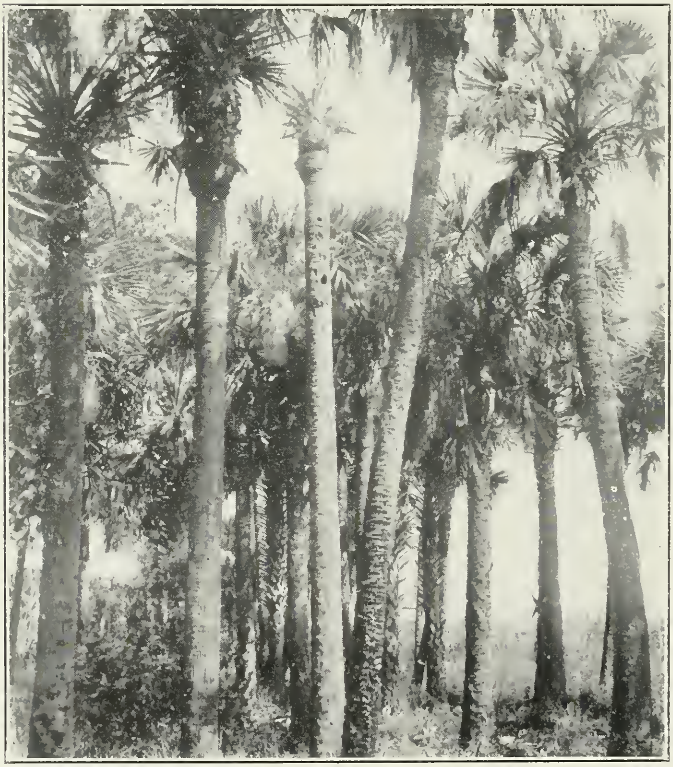
Orange County, Fla., April 14, 1932. W. H. Nicholson.

NESTING STUB AND OPENED NEST OF FLORIDA SCREECH OWL.



Pensacola, Fla. F. M. Weston.

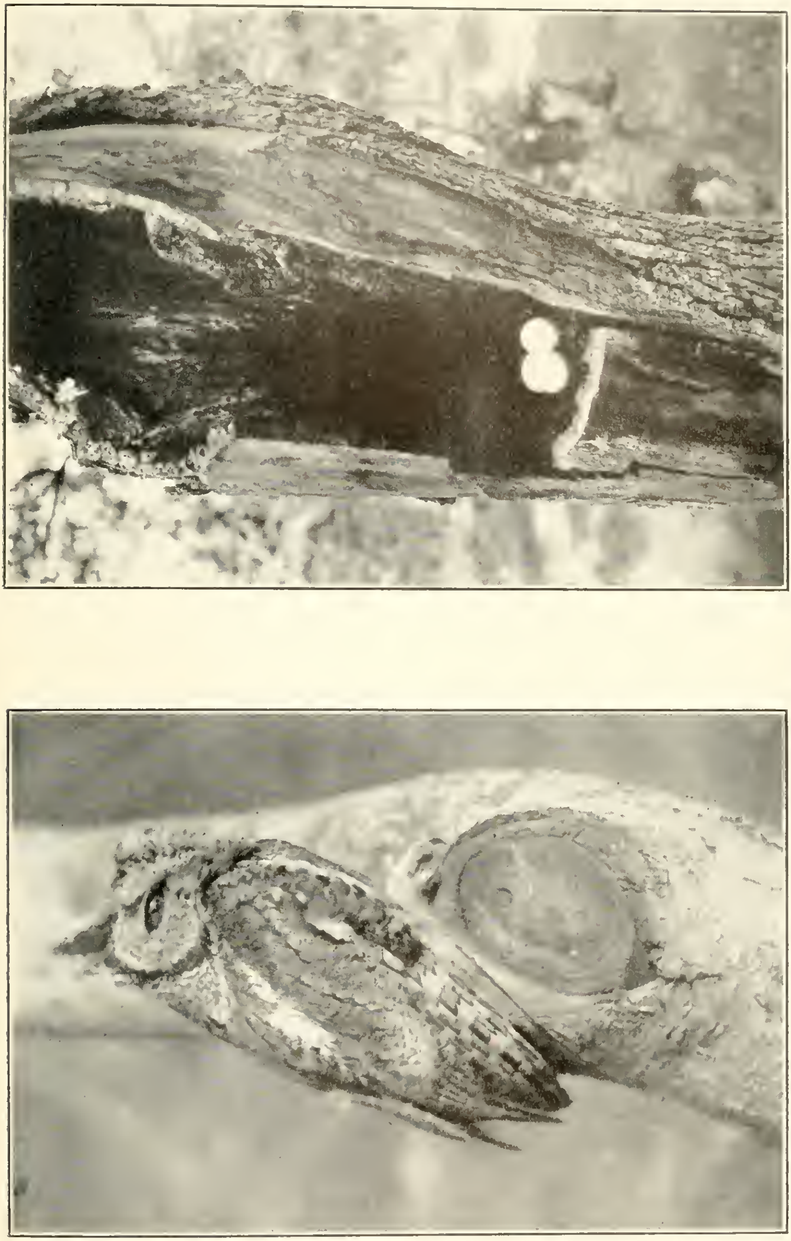
Nesting site in low stub.



Oak Lodge, Fla., April 24, 1902. A. C. Bent.

Nesting site in dead palmetto.

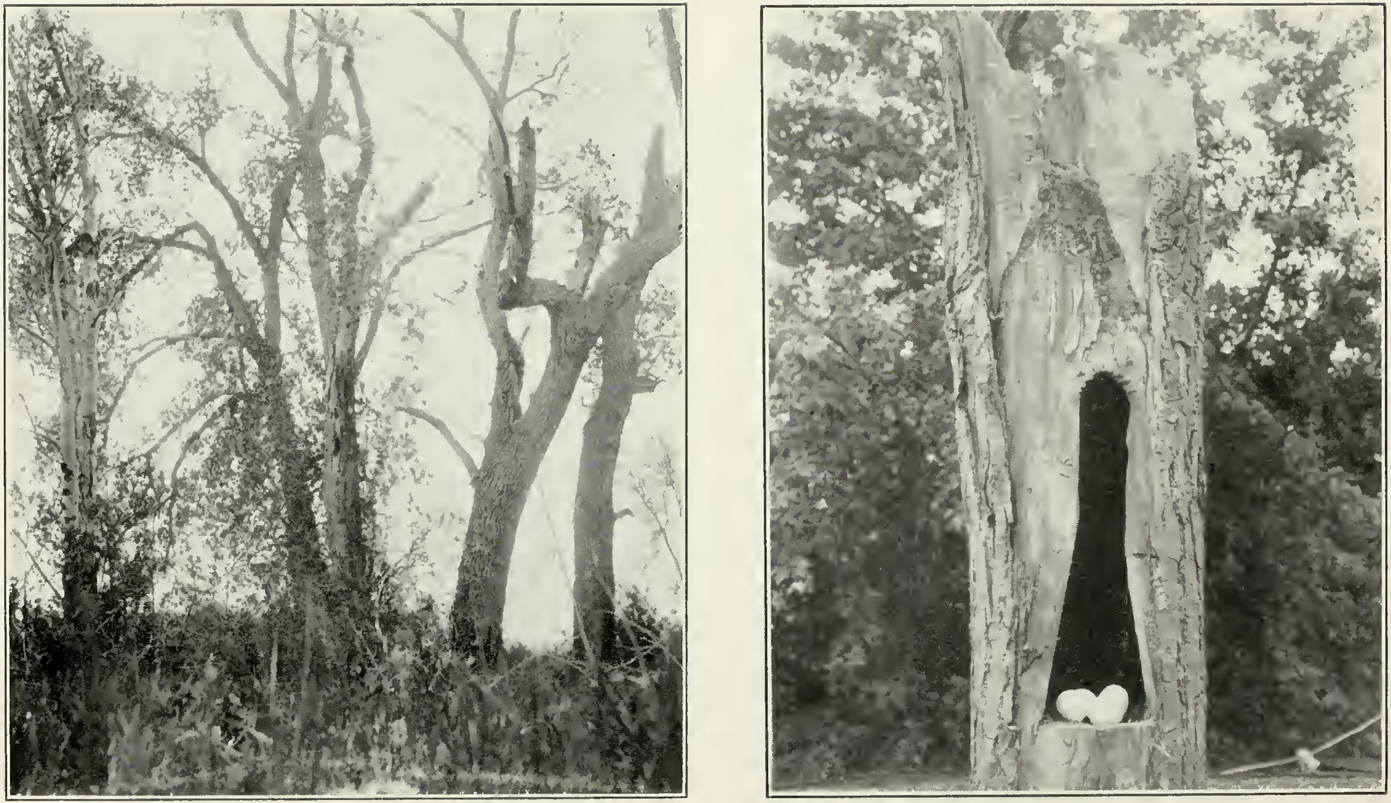
NESTING OF FLORIDA SCREECH OWL.



J. E. Patterson.

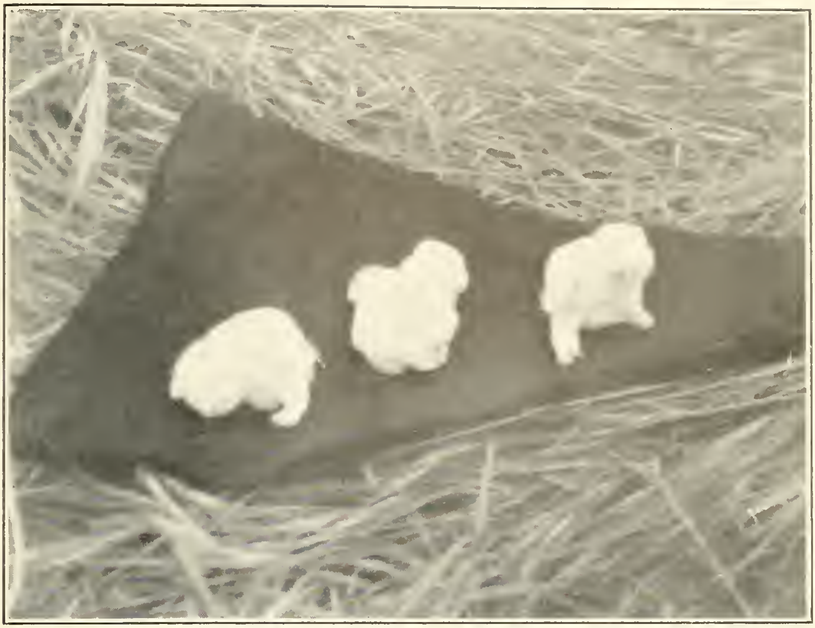
Bear Creek, Oreg., May 6, 1928.

ADULT AND OPENED NEST OF KENNICOTT'S SCREECH OWL.



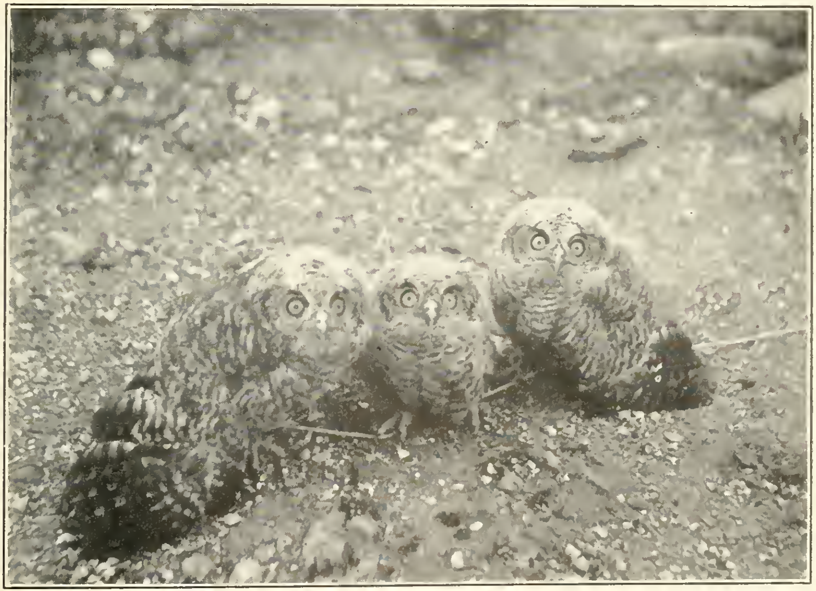
Colorado. R. B. Rockwell.

NESTING SITE AND OPENED NEST OF ROCKY MOUNTAIN SCREECH OWL.



Claremont, Calif., May 5, 1927. E. L. Sumner, Jr.

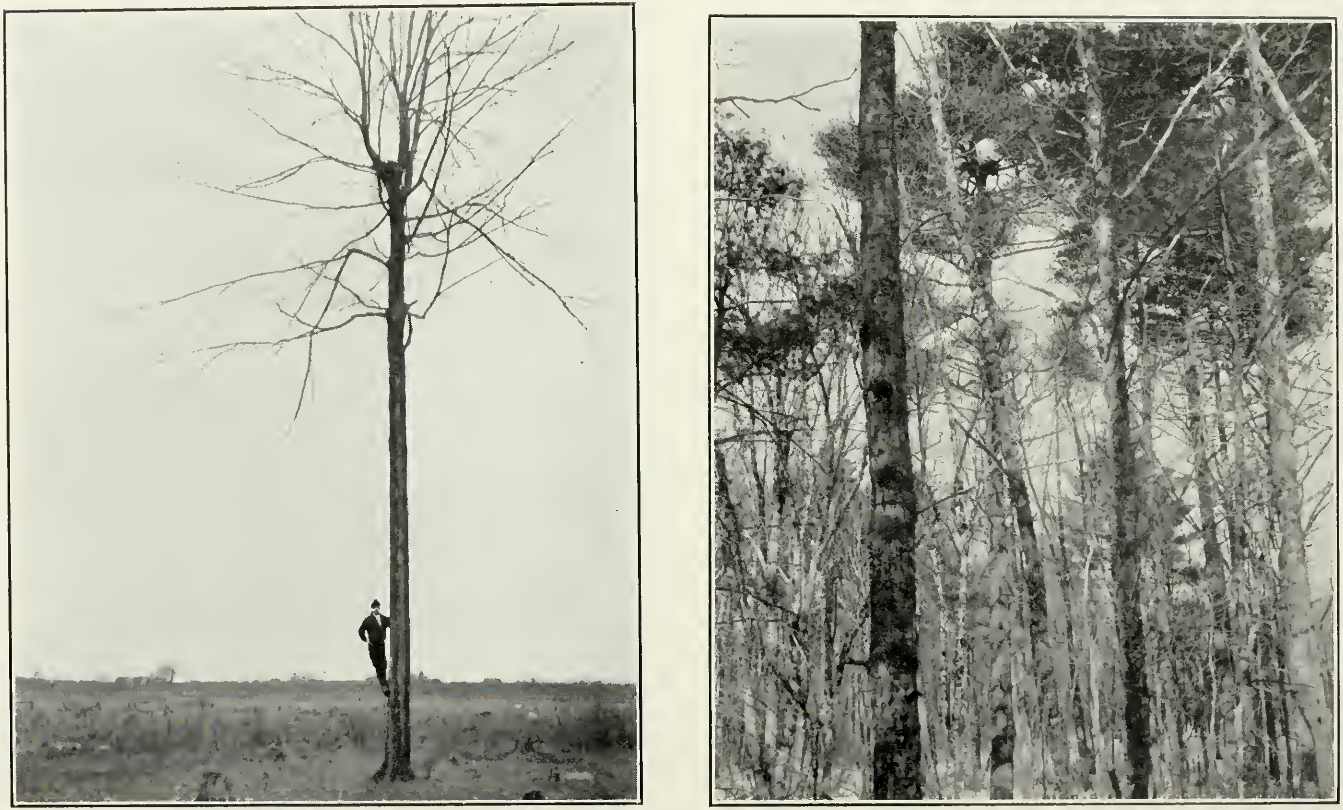
Recently hatched.



Claremont, Calif., May 20, 1928. E. L. Sumner, Jr.

Averaging 30 days old.

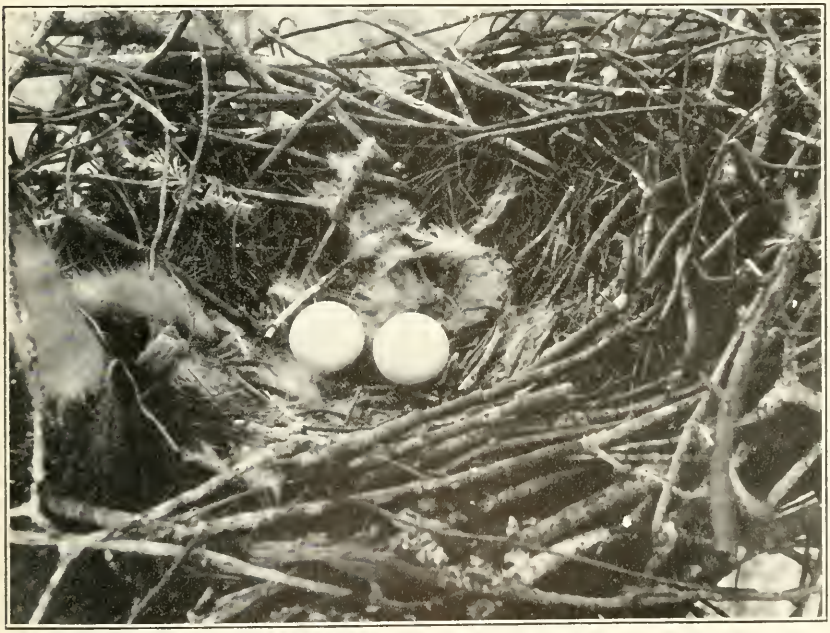
YOUNG PASADENA SCREECH OWLS.



Lyndonville, N. Y., April 9, 1926. W. A. Smith.

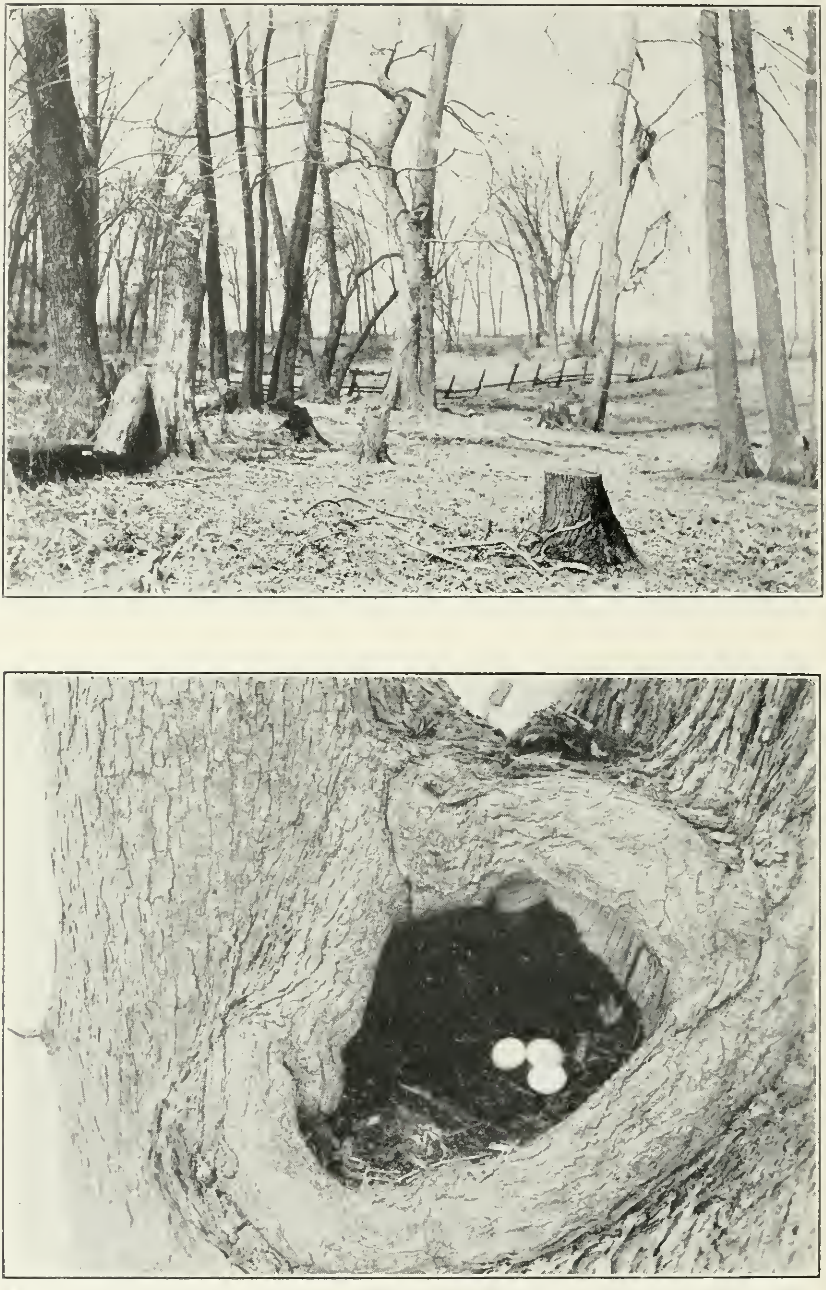
Taunton, Mass., March 4, 1906. A. C. Bent.

NESTING SITES OF GREAT HORNED OWLS.



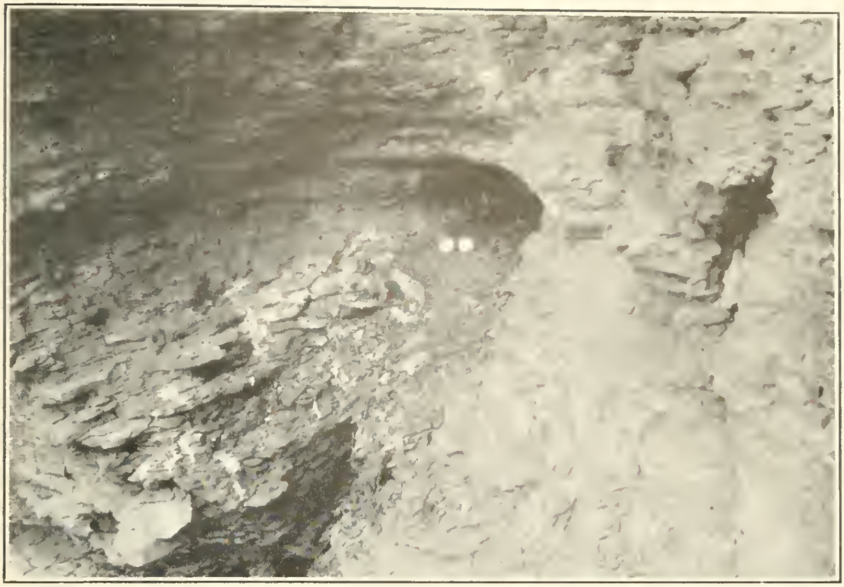
Taunton, Mass., March 4, 1906. A. C. Bent.

TWO VIEWS OF SAME NEST OF GREAT HORNED OWL.



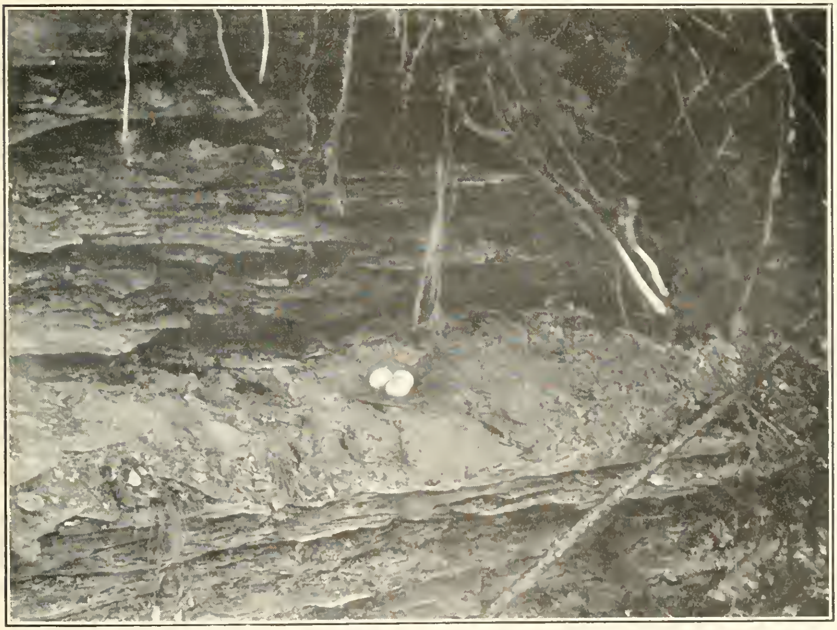
Mount Vernon, Iowa. C. R. Keyes.

NESTING SITE AND NEST OF GREAT HORNED OWL.



Nashville, Tenn. H. S. Vaughn.

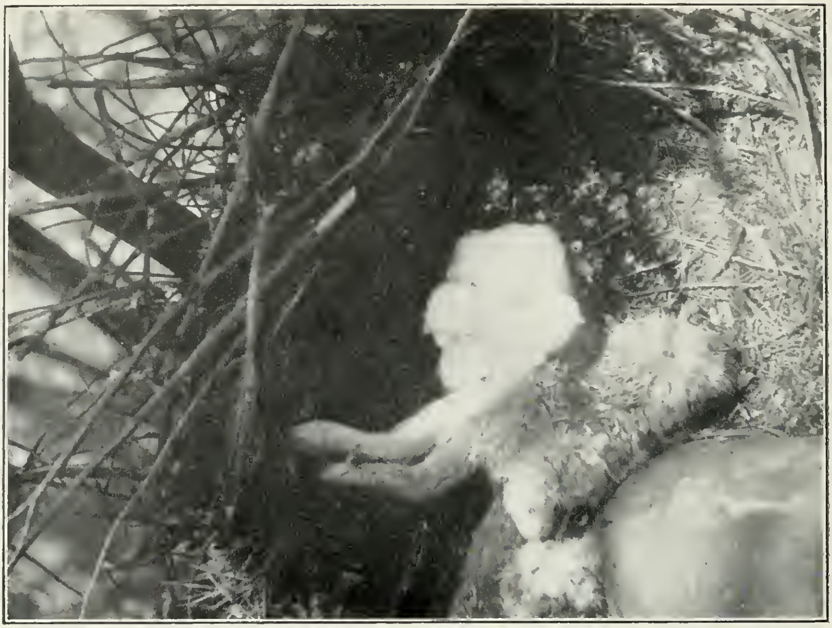
Nest in Cumberland River bluffs.



Branchport, N. Y., March 28, 1915. V. Burtch.

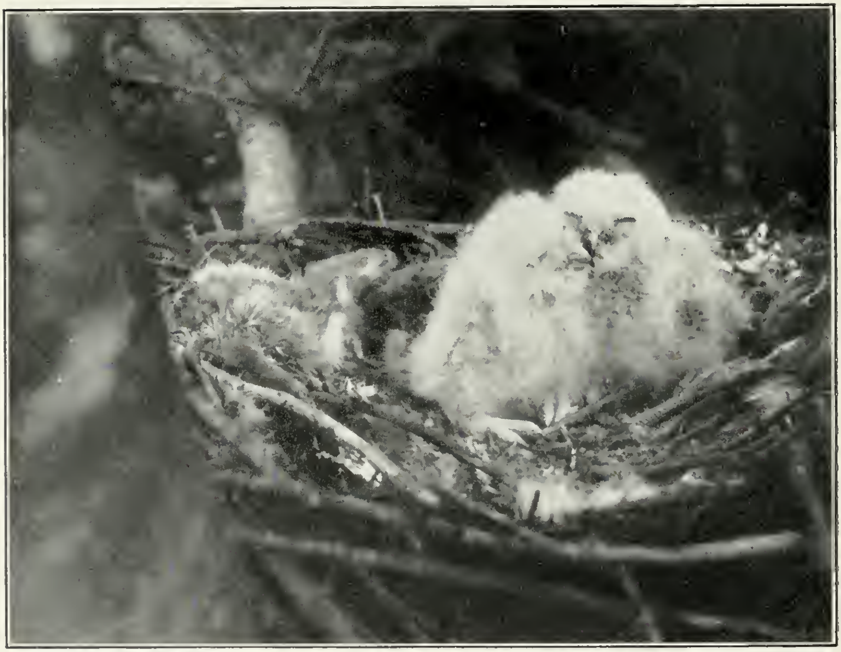
Nest on a cliff.

NESTS OF GREAT HORNED OWLS.



Raynham, Mass., April 14, 1907. A. C. Bent.

Two to four days old.



Middleboro, Mass., April 14, 1907. A. C. Bent.

Averaging about nine days old.

YOUNG GREAT HORNED OWLS.

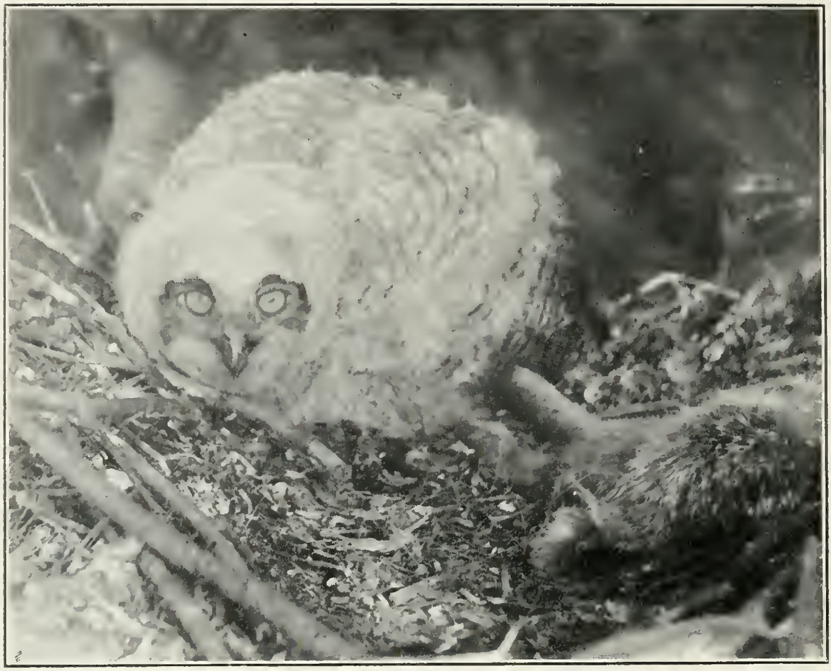
Raynham, Mass., May 12, 1907. A. C. Bent.

Young on ground, averaging about 30 days old.

Raynham, Mass., April 25, 1907. A. C. Bent.

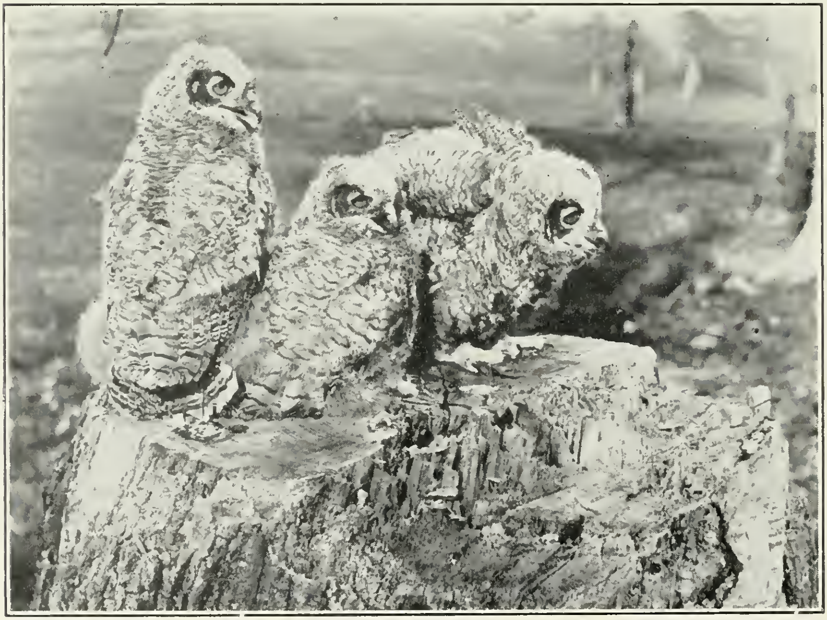
Averaging about two weeks old.

YOUNG GREAT HORNED OWLS.



Middleboro, Mass., May 5, 1907. A. C. Bent.

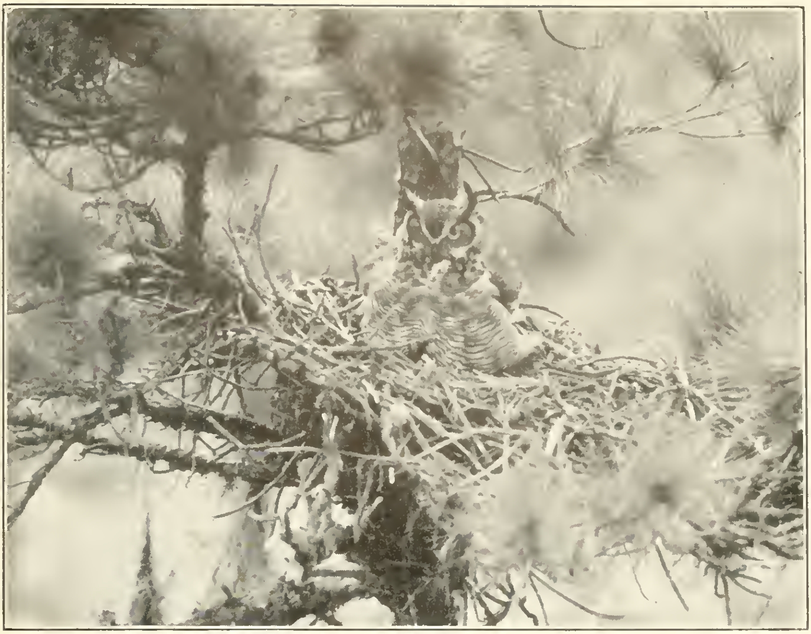
Young in nest, about four weeks old.



Mount Vernon, Iowa. C. R. Keyes.

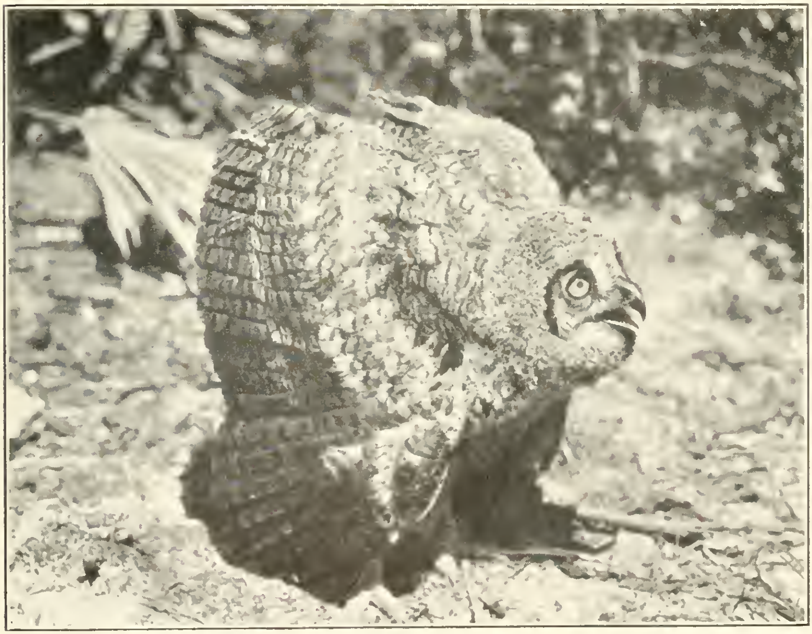
Young 41, 43, and 45 days old.

GREAT HORNED OWLS.



Duval County, Fla., February 15, 1933. S. A. Grimes.

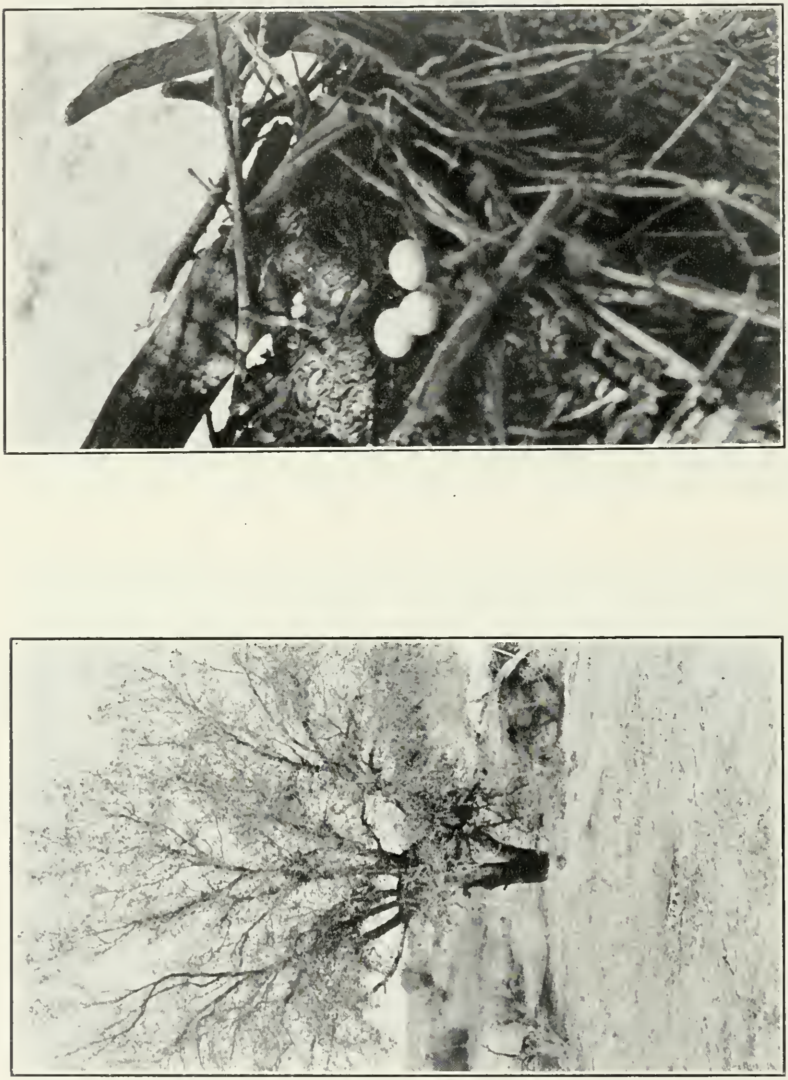
Adult on nest.



Duval County, Fla., April 9, 1930. S. A. Grimes.

Young about ready to leave nest.

GREAT HORNED OWLS.

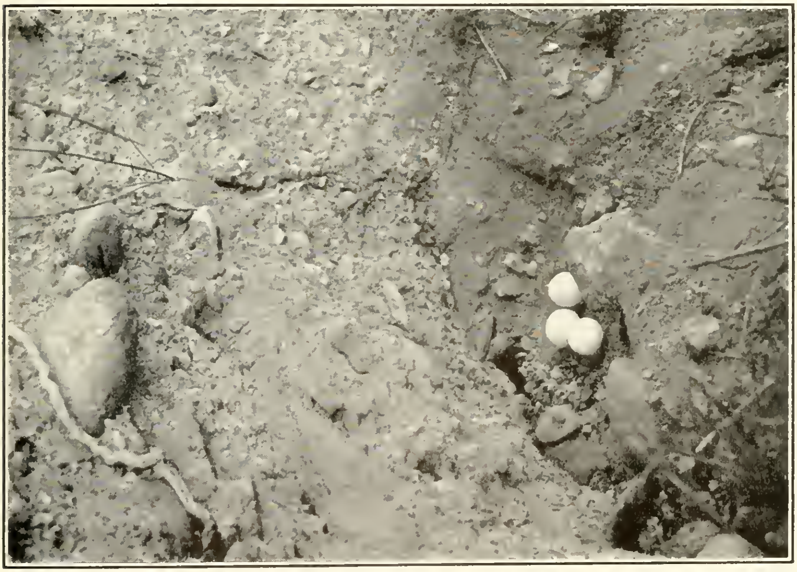


Uvalde County, Tex., February 15, 1936.

E. T. Stuart, Jr.

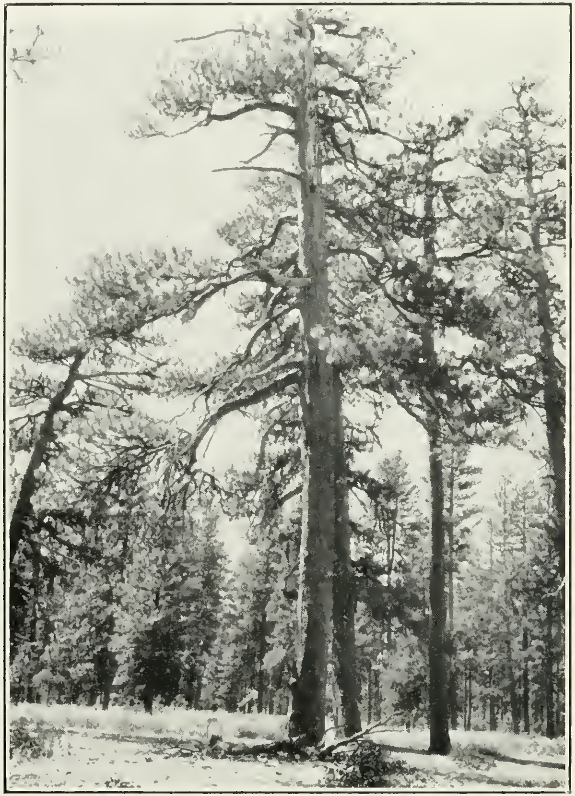
NEST TREE AND NEST OF WESTERN HORNED OWL.

Los Angeles County, Calif., February 28, 1929. A. C. Bent.

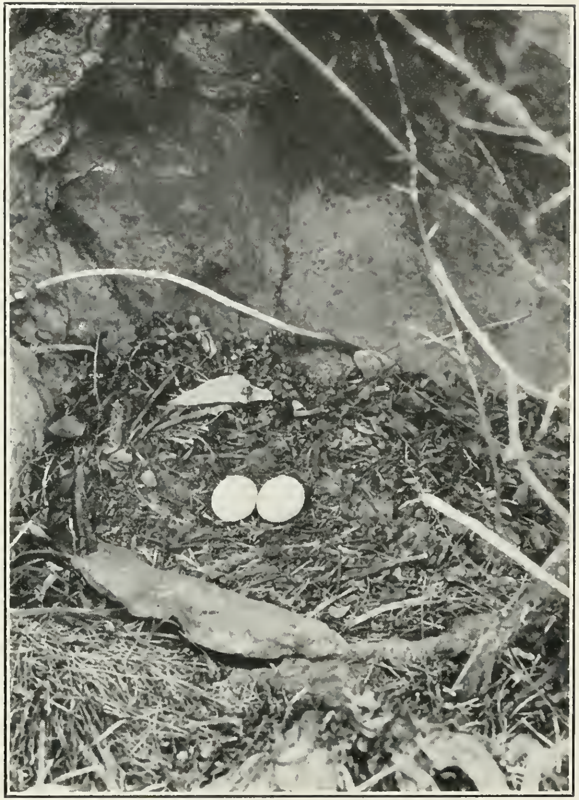


Near Claremont, Calif. W. M. Pierce.

CLIFF NEST AND NEST TREE OF PACIFIC HORNED OWL.

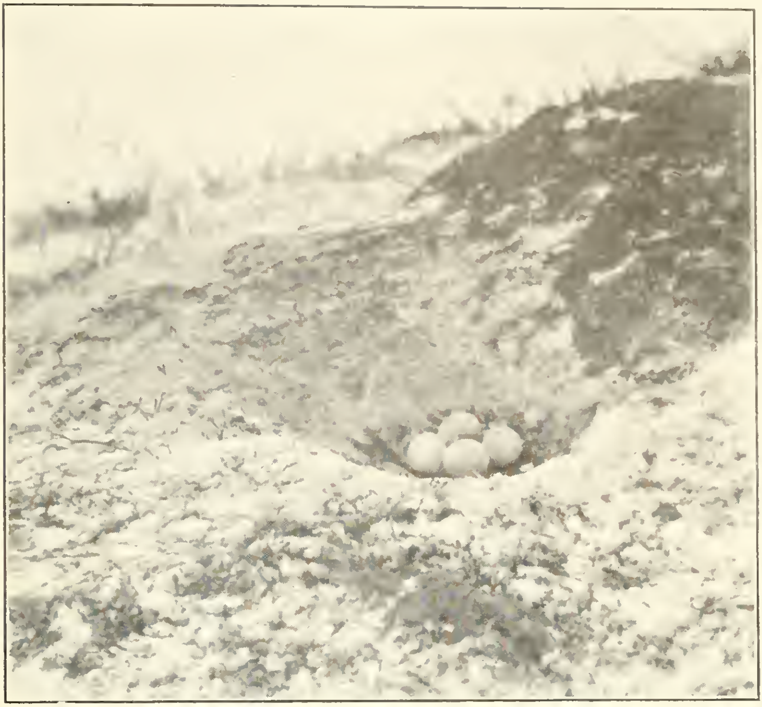


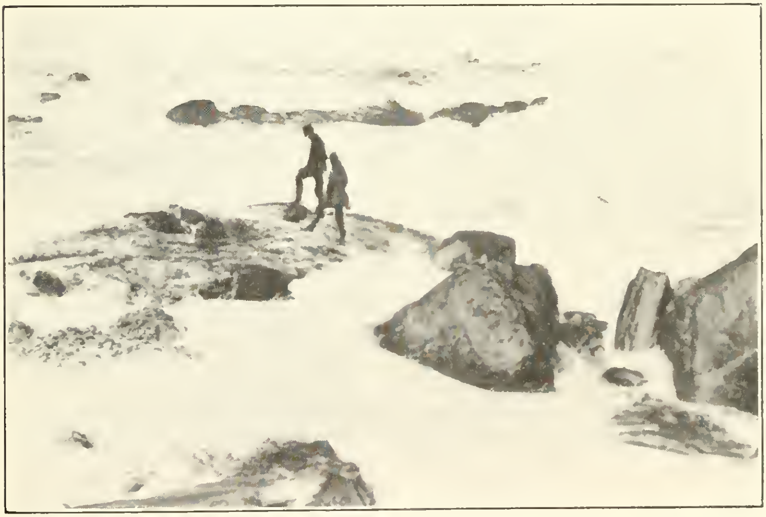
Pinehurst, Oreg., May 6, 1921. J. E. Patterson.



Ashland, Oreg., March 12, 1932. J. E. Patterson.

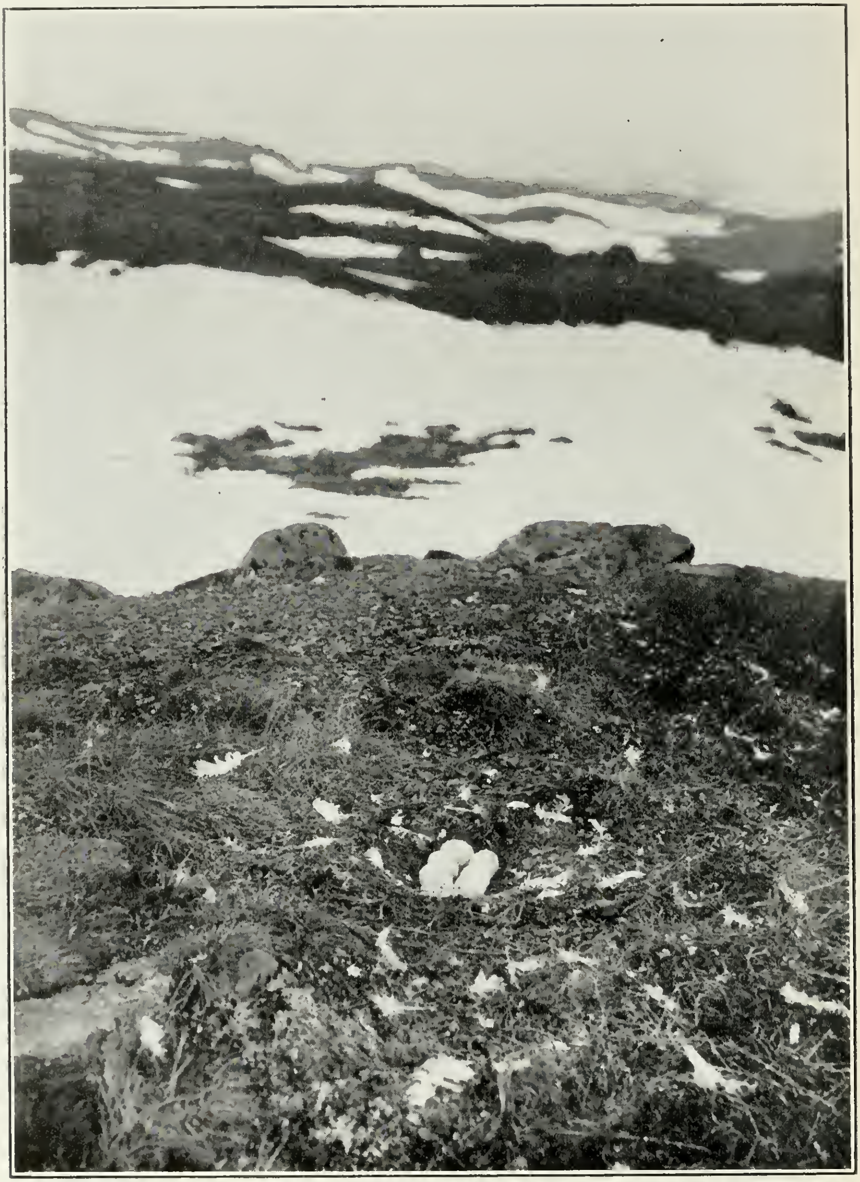
NESTING TREE AND CLIFF NEST OF MONTANA HORNED OWL.





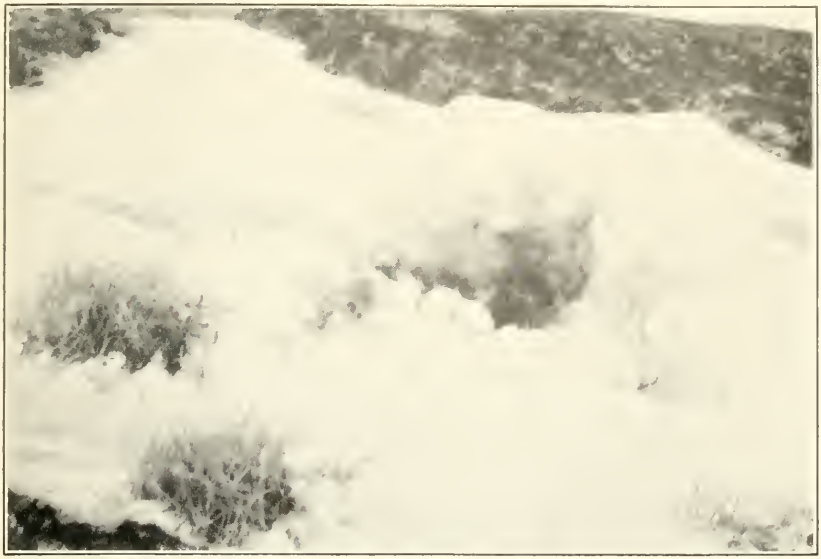
Swedish Lapland, June 7, 1924. J. H. McNeile.

NEST SITE AND NEST OF SNOWY OWL.



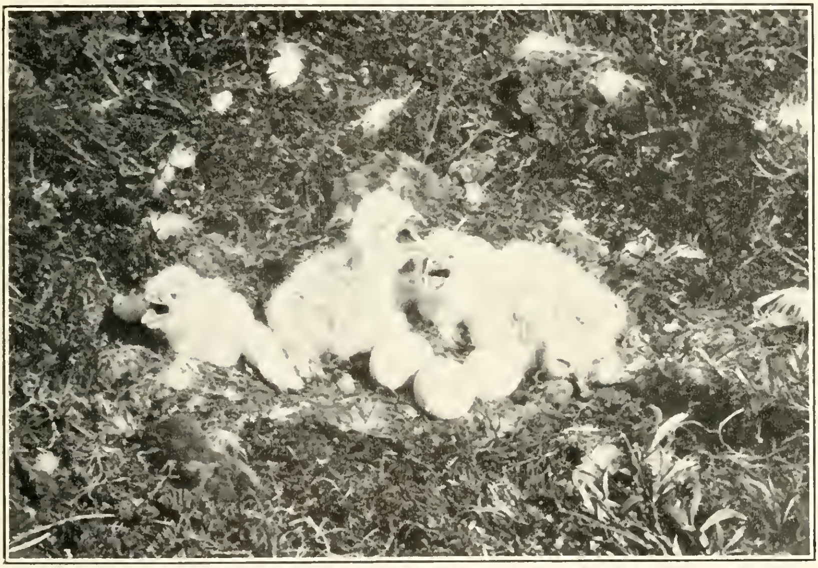
Swedish Lapland, June 11, 1924. J. H. McNeile.

NEST OF SNOWY OWL.



Southampton Island. G. M. Sutton.

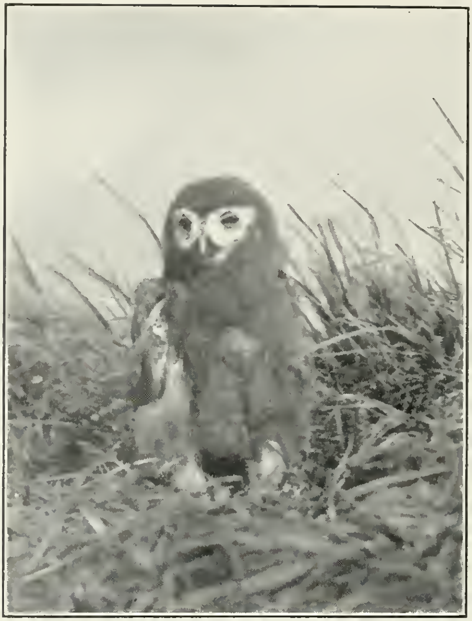
Nest surrounded by snow.



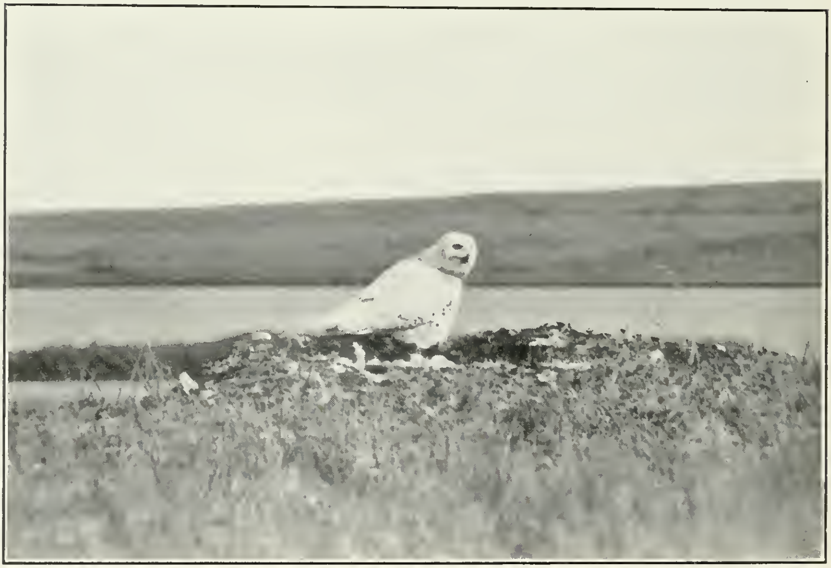
Nome, Alaska. A. M. Bailey.

Young in white natal down.

SNOWY OWLS.



Young in gray down.

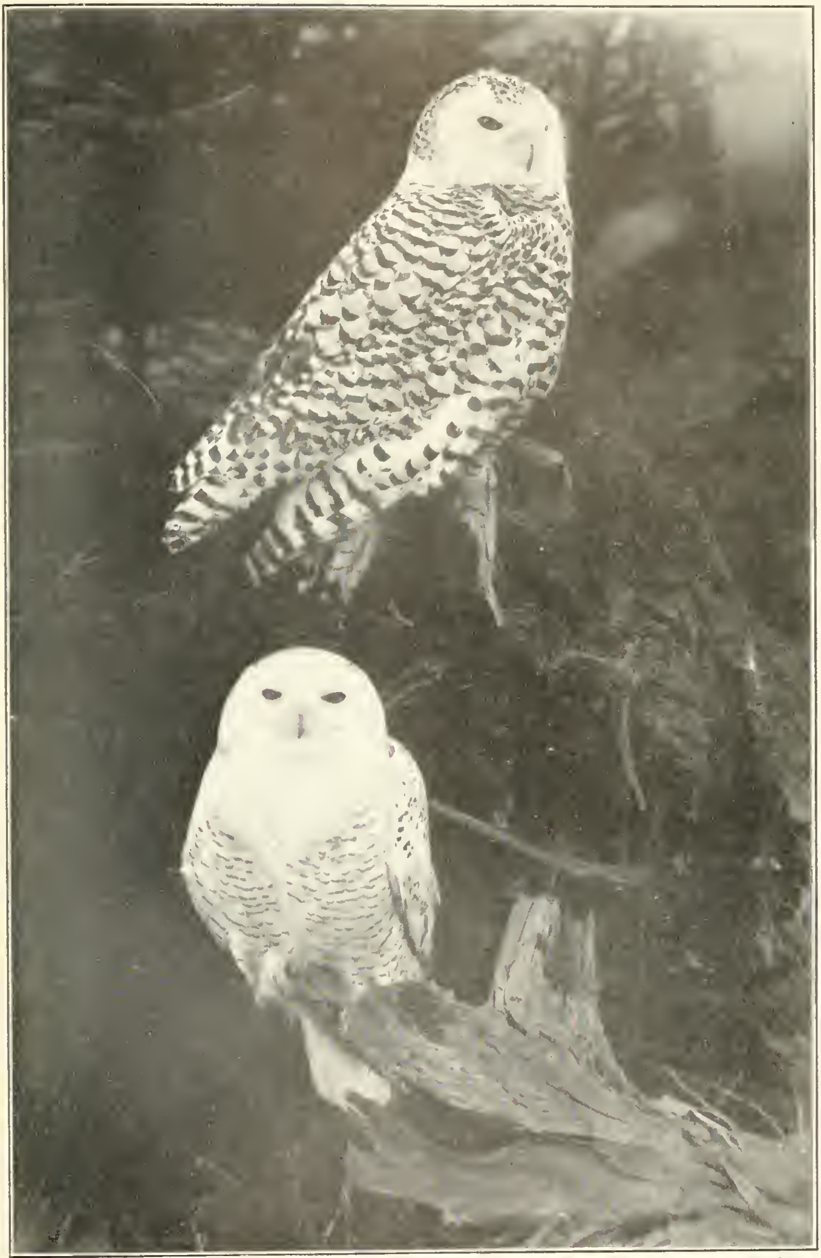


Alaska.
Courtesy U. S. Biological Survey.

O. J. Murie.

Adult at nest.

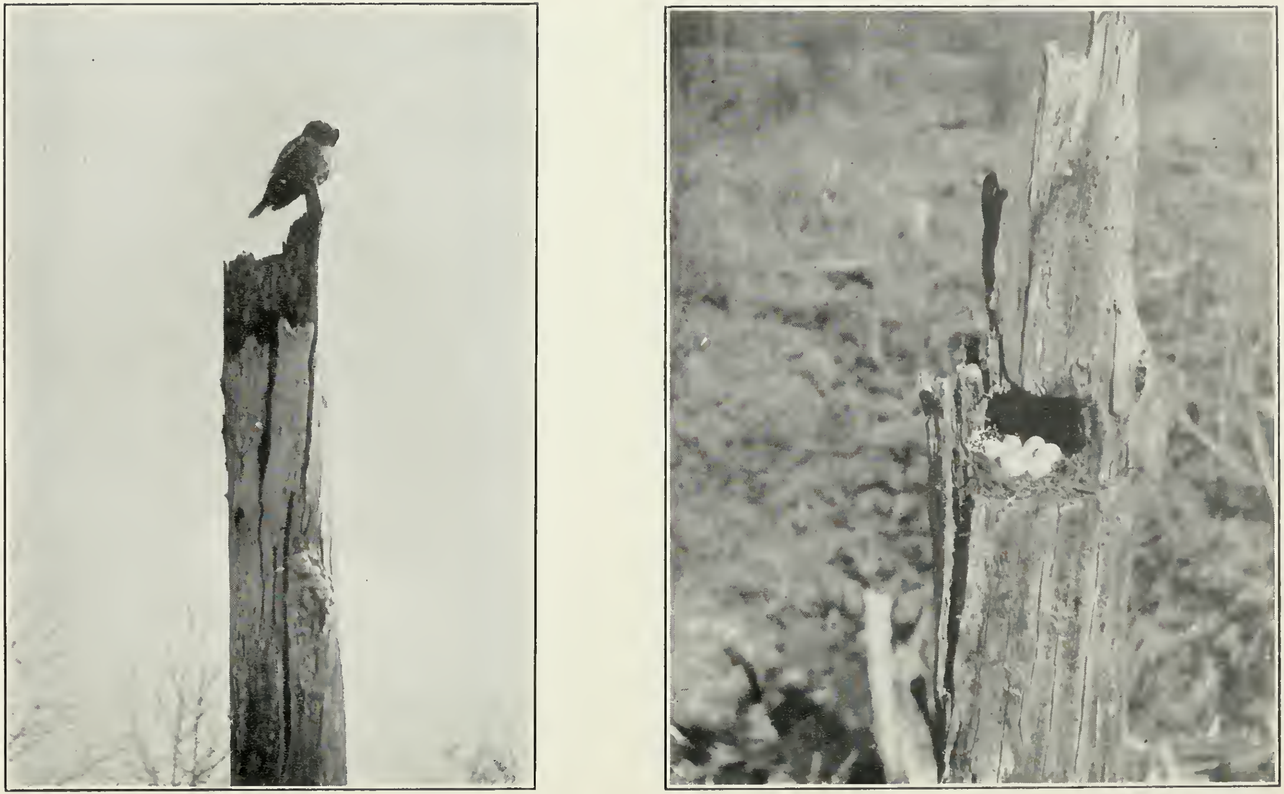
SNOWY OWLS.



Brunswick, Maine, November 21, 1926.

A. O. Gross.

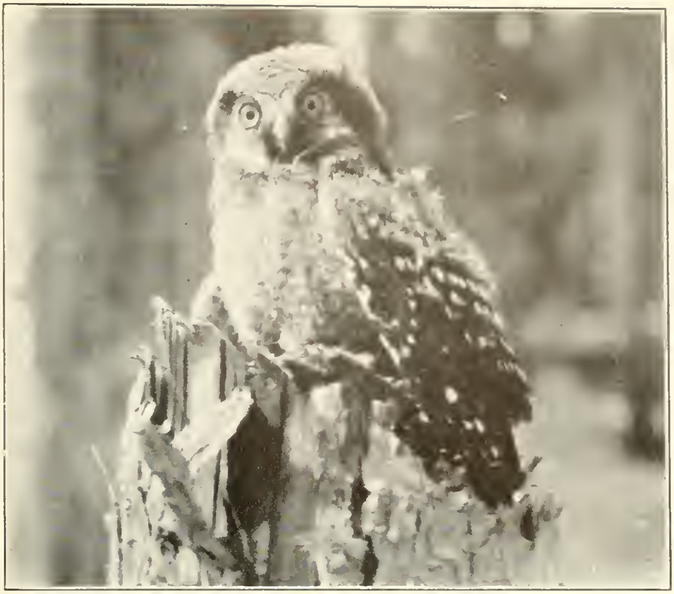
PAIR OF CAPTIVE ADULT SNOWY OWLS. FEMALE ABOVE. MALE BELOW.



Belvedere, Alberta, April 5, 1915.

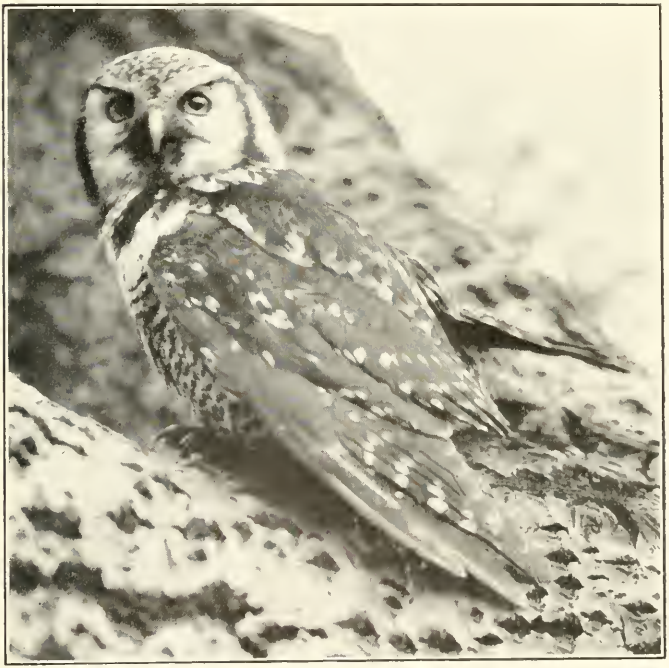
A. D. Henderson.

NESTING STUB AND OPENED NEST OF AMERICAN HAWK OWL.



Belvedere, Alberta, June 22, 1924. R. H. Rauch.

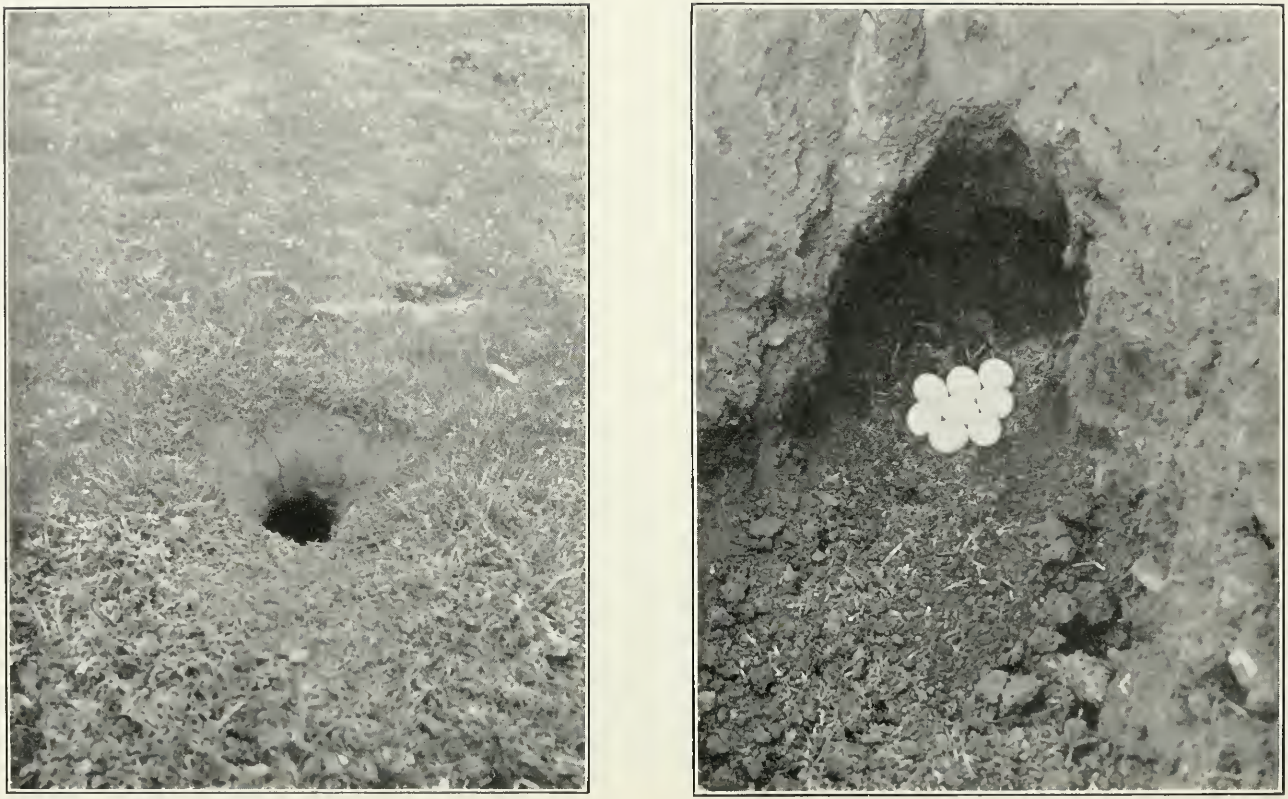
Young in juvenal plumage.



Sault Ste. Marie, Mich., September 27, 1926. K. Christofferson.

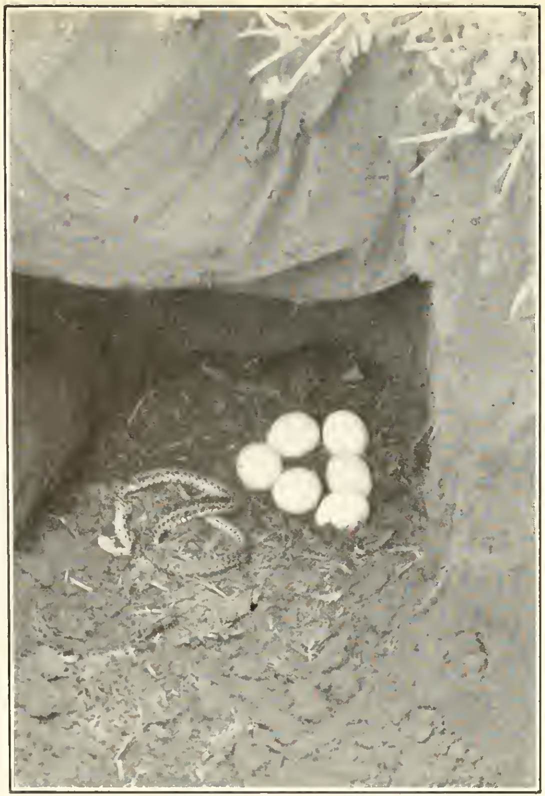
Captive adult.

AMERICAN HAWK OWLS.



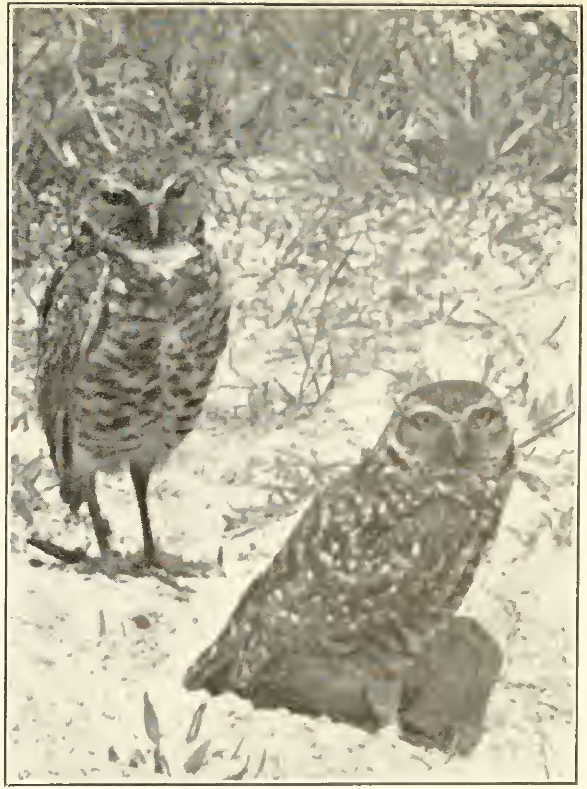
Eagle Point, Oreg., May 10, 1924. J. E. Patterson.

BURROW ENTRANCE AND EXCAVATED BURROW OF WESTERN BURROWING OWL.



San Bernardino County, Calif., April 16, 1916. W. M. Pierce.

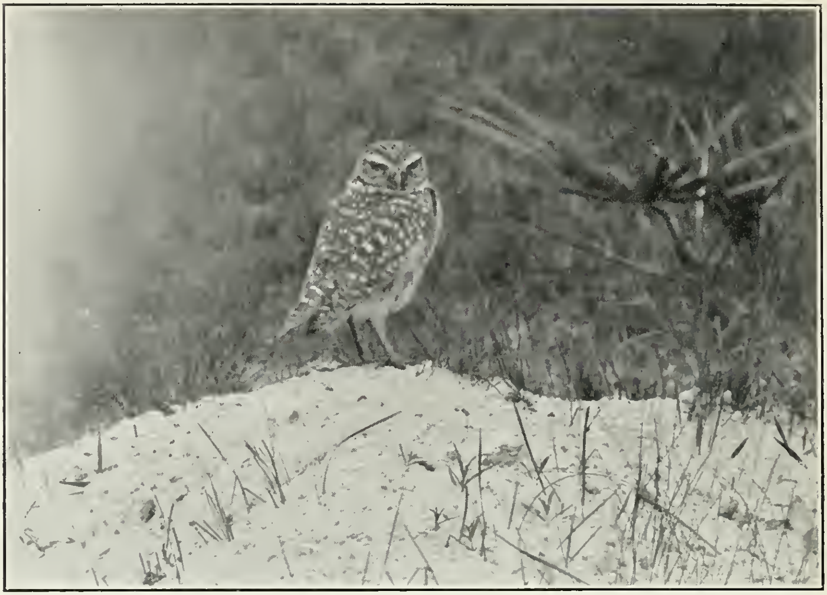
Excavated burrow of western burrowing owl.



Plant City, Fla., May 1934. A. M. Bailey.
Courtesy Chicago Academy of Sciences.

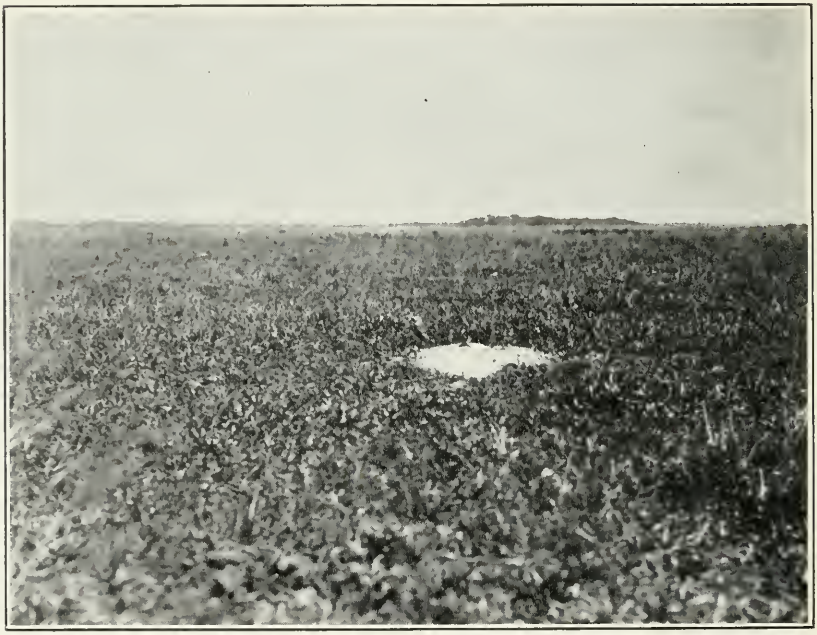
Pair of adults of Florida burrowing owl.

BURROWING OWLS.



Bassinger, Fla., March 20, 1925. A. C. Bent.

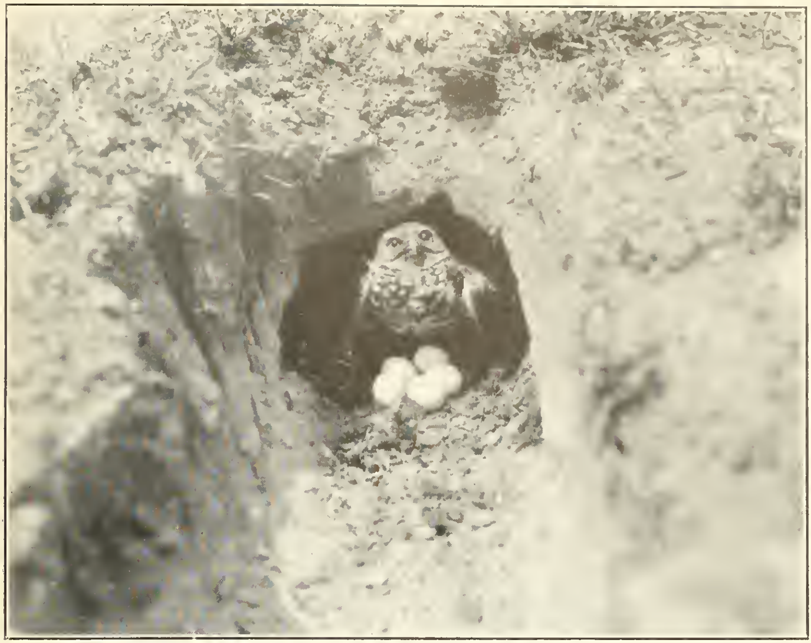
Adult on nest mound.



D. J. Nicholson.

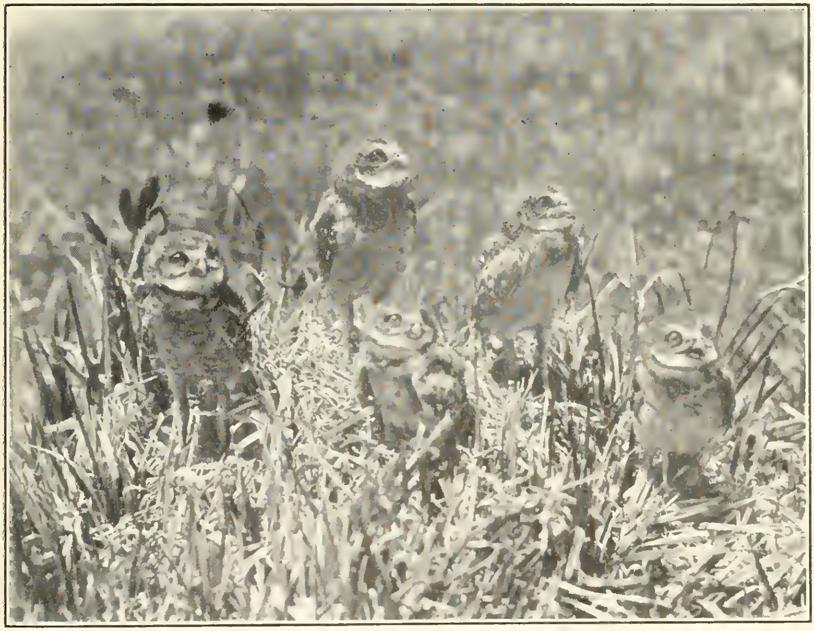
Nesting site.

FLORIDA BURROWING OWL.



Osceola County, Fla., April 15, 1932. W. H. Nicholson.

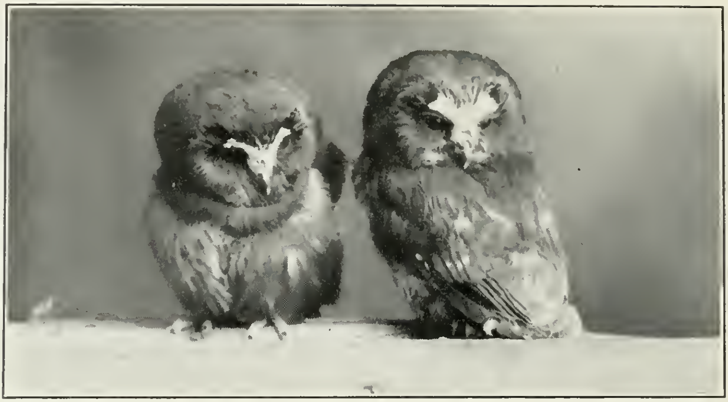
Adult on nest.



Osceola County, Fla., May 31, 1932. W. H. Nicholson.

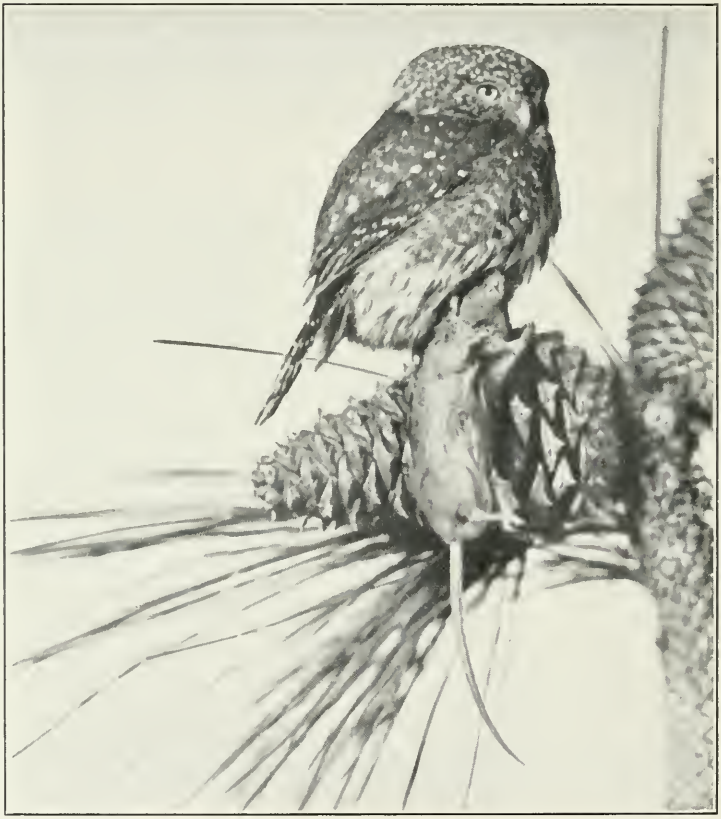
Young in juvenal plumage.

FLORIDA BURROWING OWLS.



Brownsville, Oreg. L. L. Haskin.

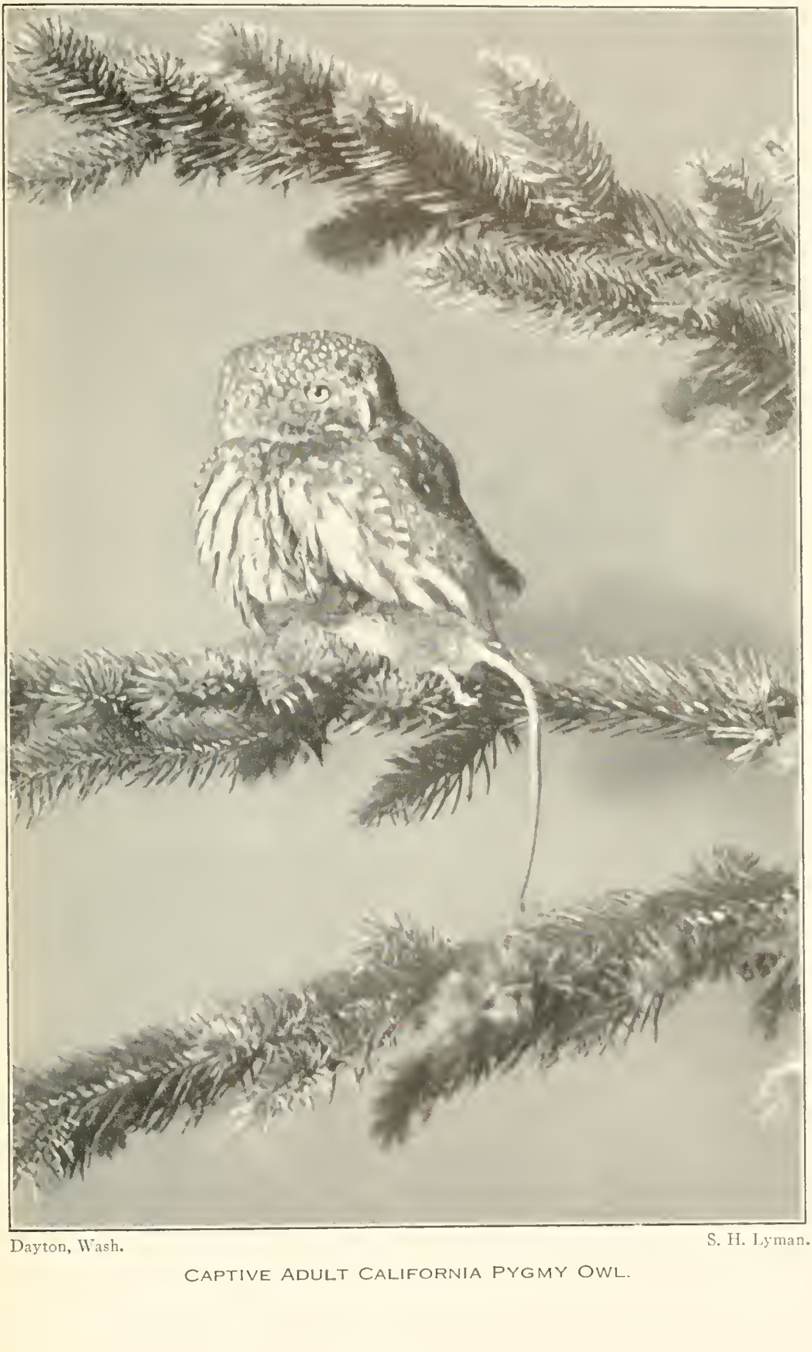
Young in juvenal plumage.



Dayton, Wash. S. H. Lyman.

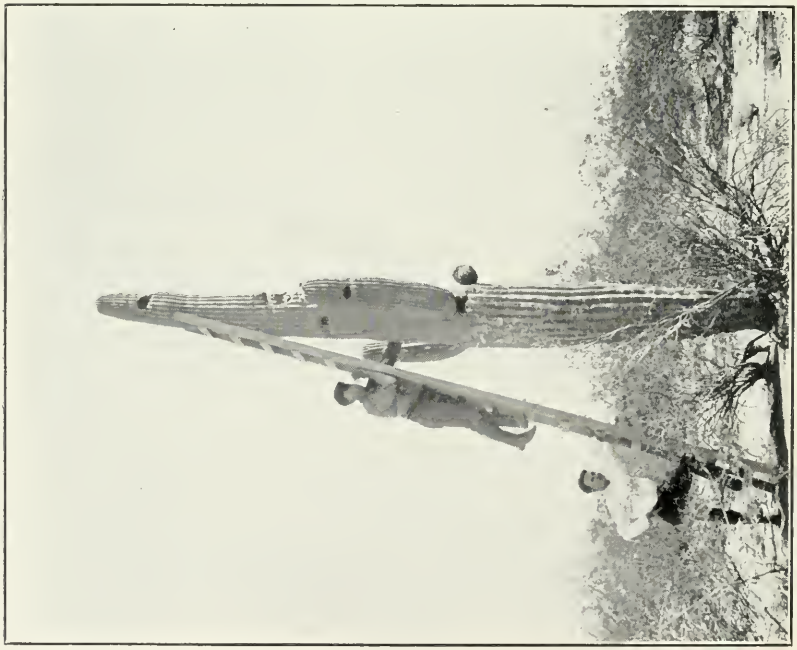
Captive adult.

CALIFORNIA PYGMY OWLS.

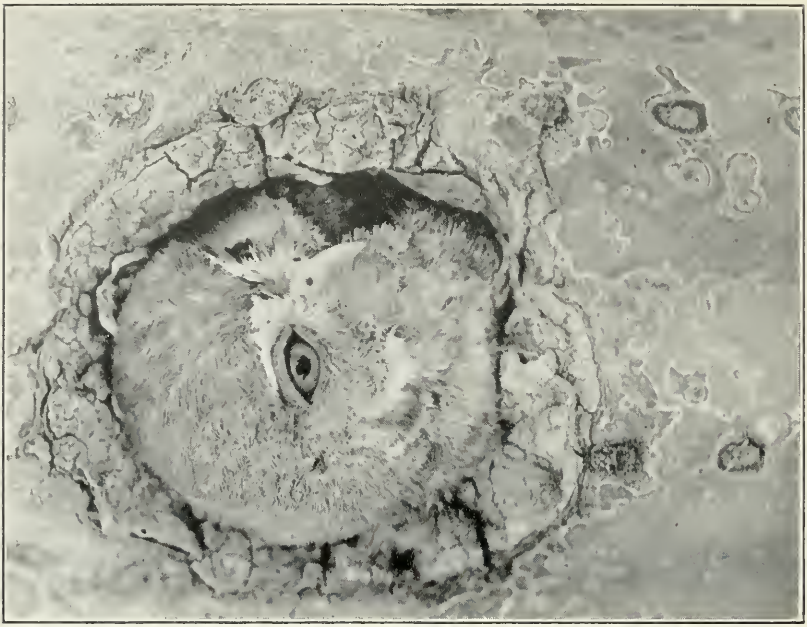


Dayton, Wash. S. H. Lyman.

CAPTIVE ADULT CALIFORNIA PYGMY OWL.



Pima County, Ariz., May 21, 1922. A. C. Bent.



Tucson, Ariz. W. L. Finley.

NESTING SITE AND ADULT OF WHITNEY'S ELF OWL.

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